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Atlas of Absorption Lines
From 0 to 17900 cm^{-1}

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Atlas of Absorption Lines
From 0 to 17900 cm⁻¹

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Description of the Atlas

This atlas is a pictorial representation of atmospheric absorption line parameters contained in the 1986 Air Force Geophysics Laboratory high-resolution transmission molecular absorption data base (HITRAN) compilation currently available on magnetic tape (Rothman et al. 1987). It is a revised edition of the atlas previously published by Park et al. (1981), which had been based on an earlier version of the compilation (Rothman et al. 1981a and 1981b). This earlier publication has become very useful as a quick reference for researchers in the fields of molecular spectroscopy and atmospheric remote sensing. Since a new, extensively revised version of the HITRAN line parameters compilation has recently been released, the authors felt that a new edition of the atlas was necessary.

In the atlas are presented plots of the logarithm (base 10) of absorption line strength (S converted from the HITRAN units of $\text{cm}^{-1}/(\text{molecule cm}^{-2})$ at 296 K to $\text{atm}^{-1}\text{cm}^{-2}$ at 296 K) versus wavenumber (in cm^{-1}) for atmospheric gases. The atlas covers the spectral range of the HITRAN compilation (0 to $17\,900\text{ cm}^{-1}$). Line parameters for all gases are taken from the 1986 version of the HITRAN compilation with additional data shown separately for $\text{O}(^3\text{P})$, isotropic O_3 (668, 686, 667, and 676), and HO_2 from the 1984 JPL compilation in the spectral region 0 to 200 cm^{-1} (Poynter and Pickett 1985). Solar CO lines at 4500 K, calculated by C. P. Rinsland, are also shown for the fundamental and first overtone sequences (Park et al. 1981). As in the HITRAN compilation, intensities of all bands are scaled according to the terrestrial abundance of each isotopic species. Approximate infrared absorption cross sections (converted from the HITRAN units of $\text{cm}^2/\text{molecule}$ to $\text{atm}^{-1}\text{cm}^{-1}$) of 11 heavy atmospheric molecules (base 10 logarithm) in the $700\text{--}1800\text{ cm}^{-1}$ region are plotted beneath the other data. These values were determined at equally spaced wavenumber intervals from room-temperature laboratory spectra (Massie et al. 1985) and are included as a separate file in the 1986 HITRAN database.

Figures 1 and 2 summarize the parameters on a compressed wavenumber scale. Figure 1 lists the molecules and shows the regions of spectral data coverage for each between 0 and $10\,000\text{ cm}^{-1}$. Figure 2 shows the absorption cross sections σ as continuous curves on a base 10 logarithm versus wavenumber scale for the $700\text{--}1800\text{ cm}^{-1}$ region. Figure 3 presents plots of the logarithm (base 10) of absorption line strength of the AFGL gases versus wavenumber for every 1000 cm^{-1} up to 5000 cm^{-1}

with the strength scale the same on all plots for each gas. This provides a view of the band structures and their relative strengths. Above $10\,000\text{ cm}^{-1}$, only H_2O occurs in the atlas except for O_2 from $11\,400$ to $11\,700\text{ cm}^{-1}$, $12\,800$ to $13\,200\text{ cm}^{-1}$, $14\,300$ to $14\,600\text{ cm}^{-1}$, and $15\,700$ to $16\,000\text{ cm}^{-1}$.

On each page of the atlas, the plots of $\log(S)$ versus wavenumber for all gases having absorption lines in the same 10 cm^{-1} interval for the $0\text{--}200\text{ cm}^{-1}$ region, 50 cm^{-1} interval for the $200\text{--}6000\text{ cm}^{-1}$ region, and 100 cm^{-1} interval for the $6000\text{--}17\,900\text{ cm}^{-1}$ region are presented in order of the integer gas codes given in figure 1. For the major gases (H_2O , CO_2 , O_3 , N_2O , CO , CH_4 , and O_2), all lines having strengths within 10^{-6} of the maximum value for that interval are shown; and for the trace gases, all lines having strengths within 10^{-4} of the maximum are included. Because the maximum and minimum line strengths are redetermined for each interval, sudden changes may appear in the line strength scale from one plot to another, and some weak lines on the HITRAN compilation are not plotted in this atlas. Isolated weak bands may also appear, at first glance, to be much stronger than expected. For the $0\text{--}200\text{ cm}^{-1}$ region, some intervals are repeated on two pages because of the large number of gases which appear in the interval; in such cases, H_2O lines are repeated at the top to be used as reference. In other regions where the number of gases appearing in an interval is small, two or three consecutive intervals are presented on the same page. For the heavy molecule cross-section data, the strength scale for each molecule is normalized to the same value, so that the scale for each of these molecules is the same on all frames. Only cross sections within 10^{-2} of the maximum value are included in the atlas.

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Hampton, VA 23665-5225
July 17, 1987

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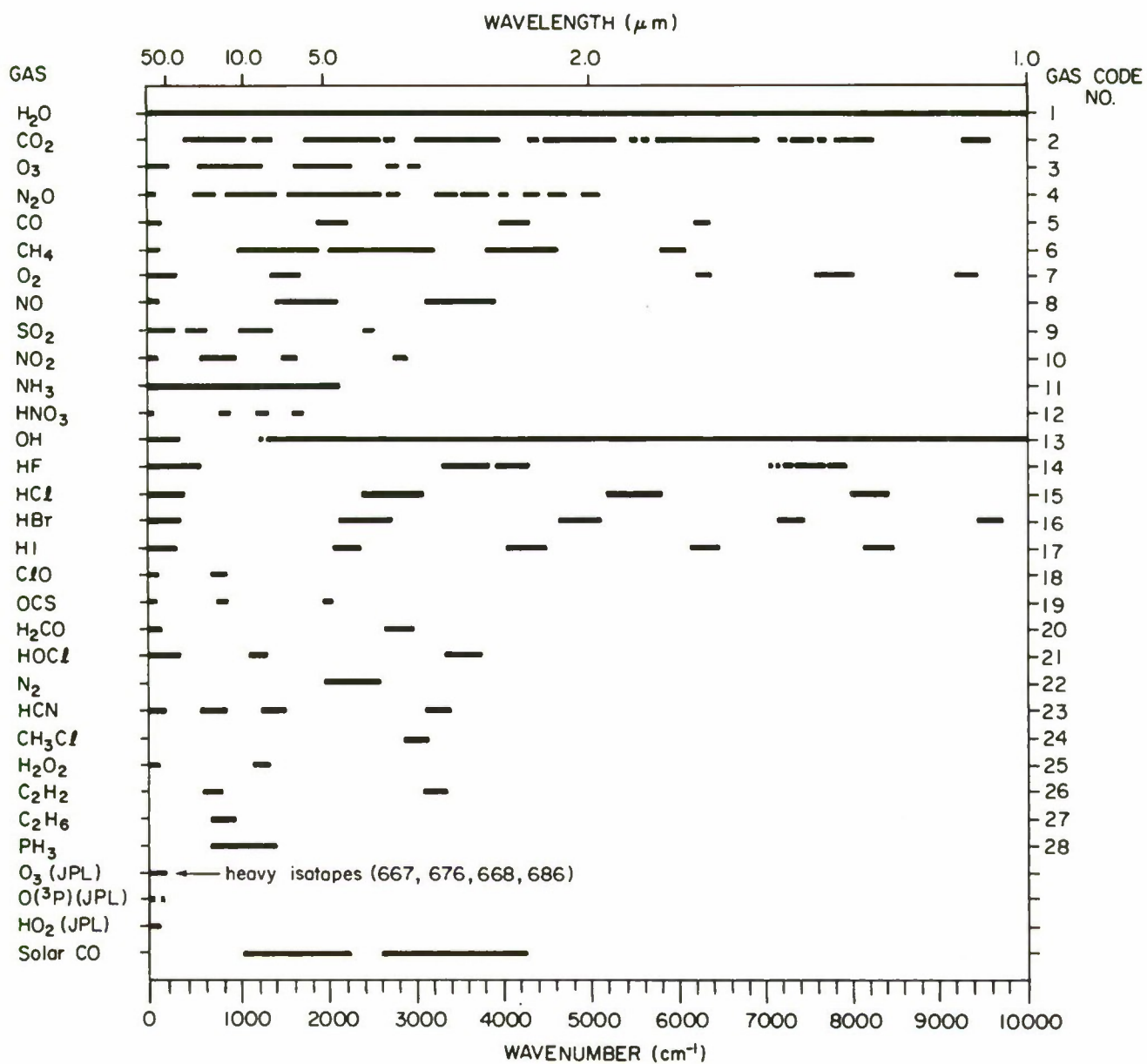


Figure 1. Spectral data coverage for each molecule between 0 and 10 000 cm^{-1} .

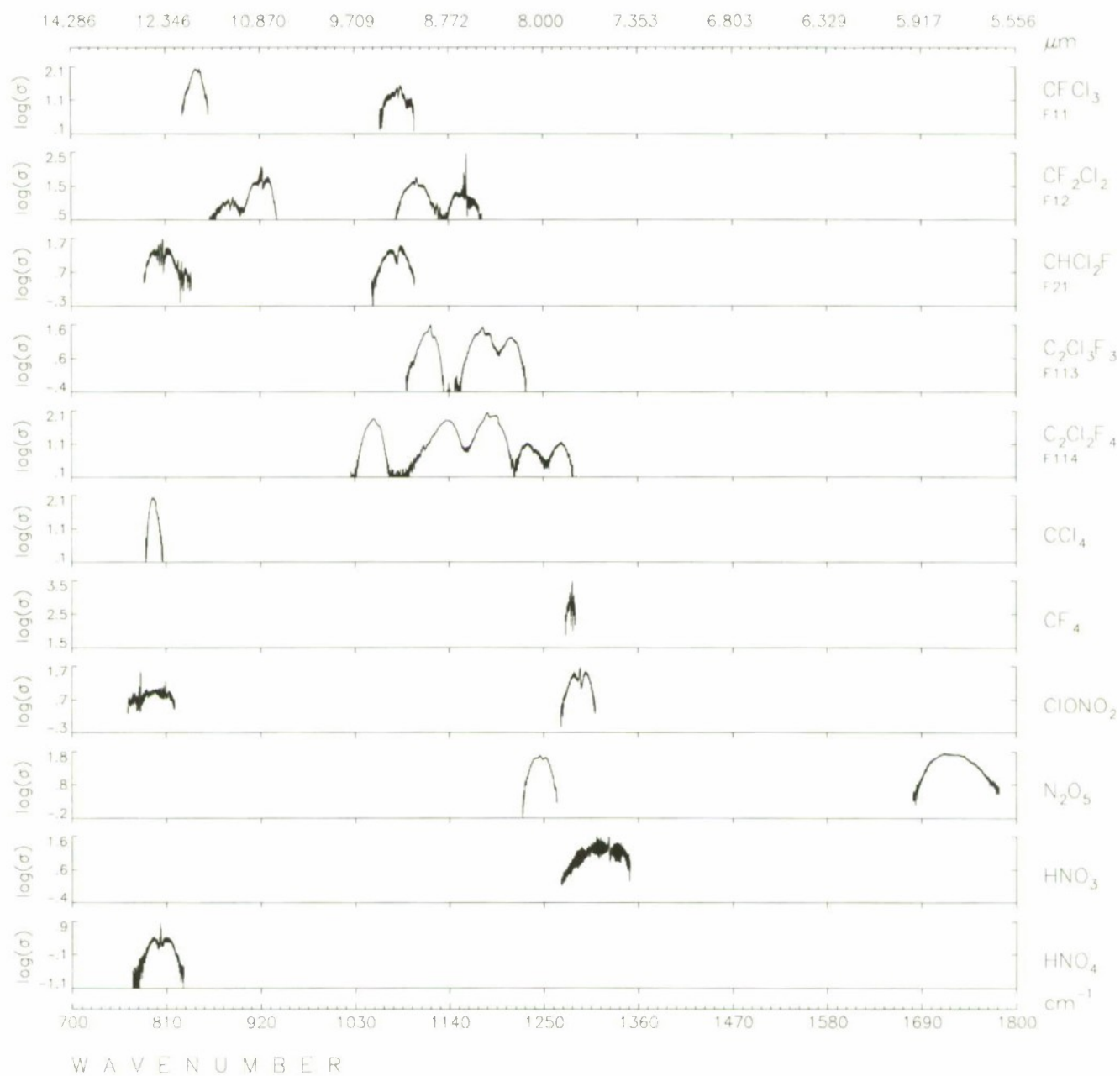


Figure 2. Absorption cross sections of 11 heavy molecules for the 700- to 1800- cm^{-1} region.

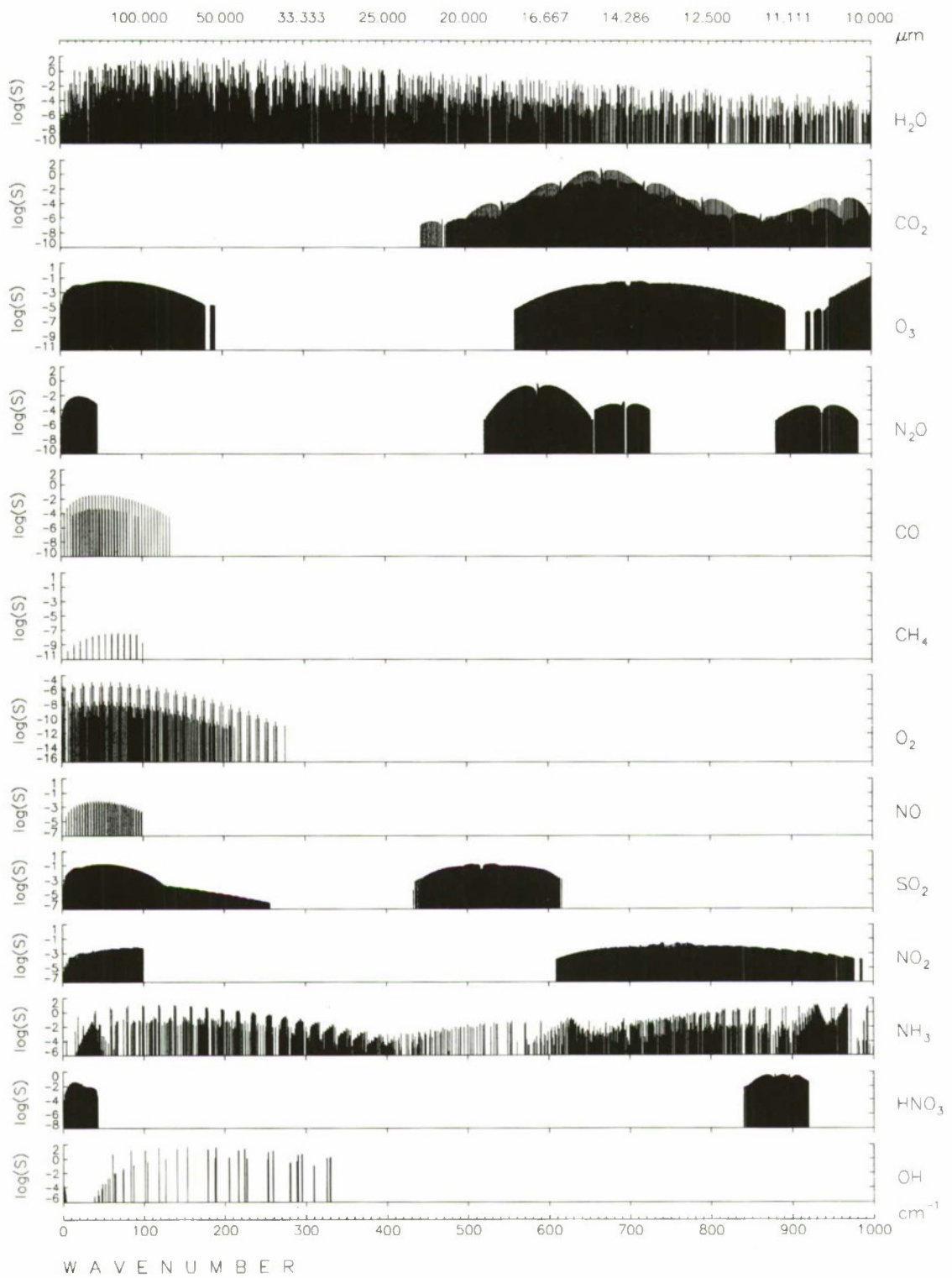


Figure 3. Absorption line strengths of AFGL gases versus wavenumber for every 1000 cm^{-1} up to 5000 cm^{-1} .

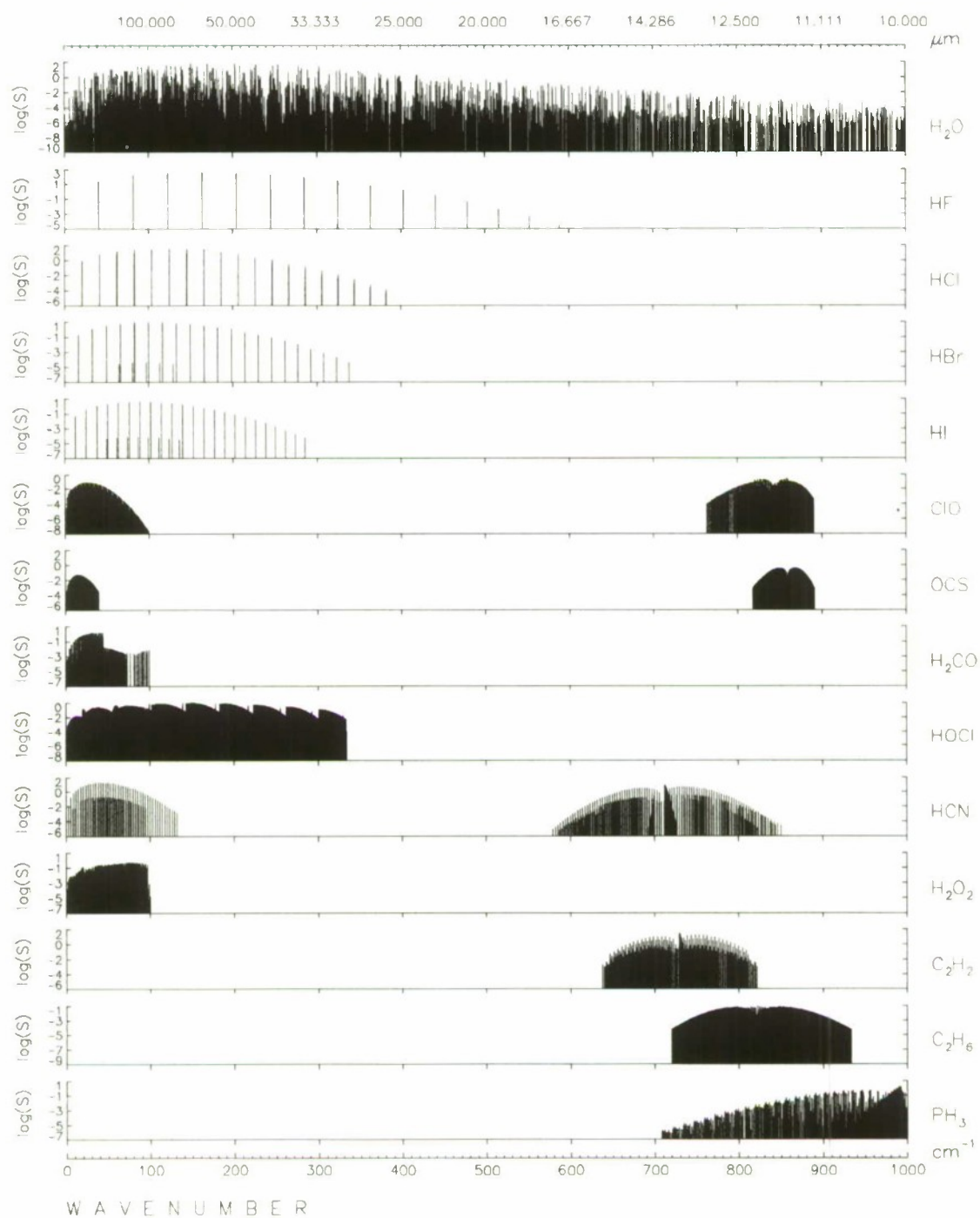


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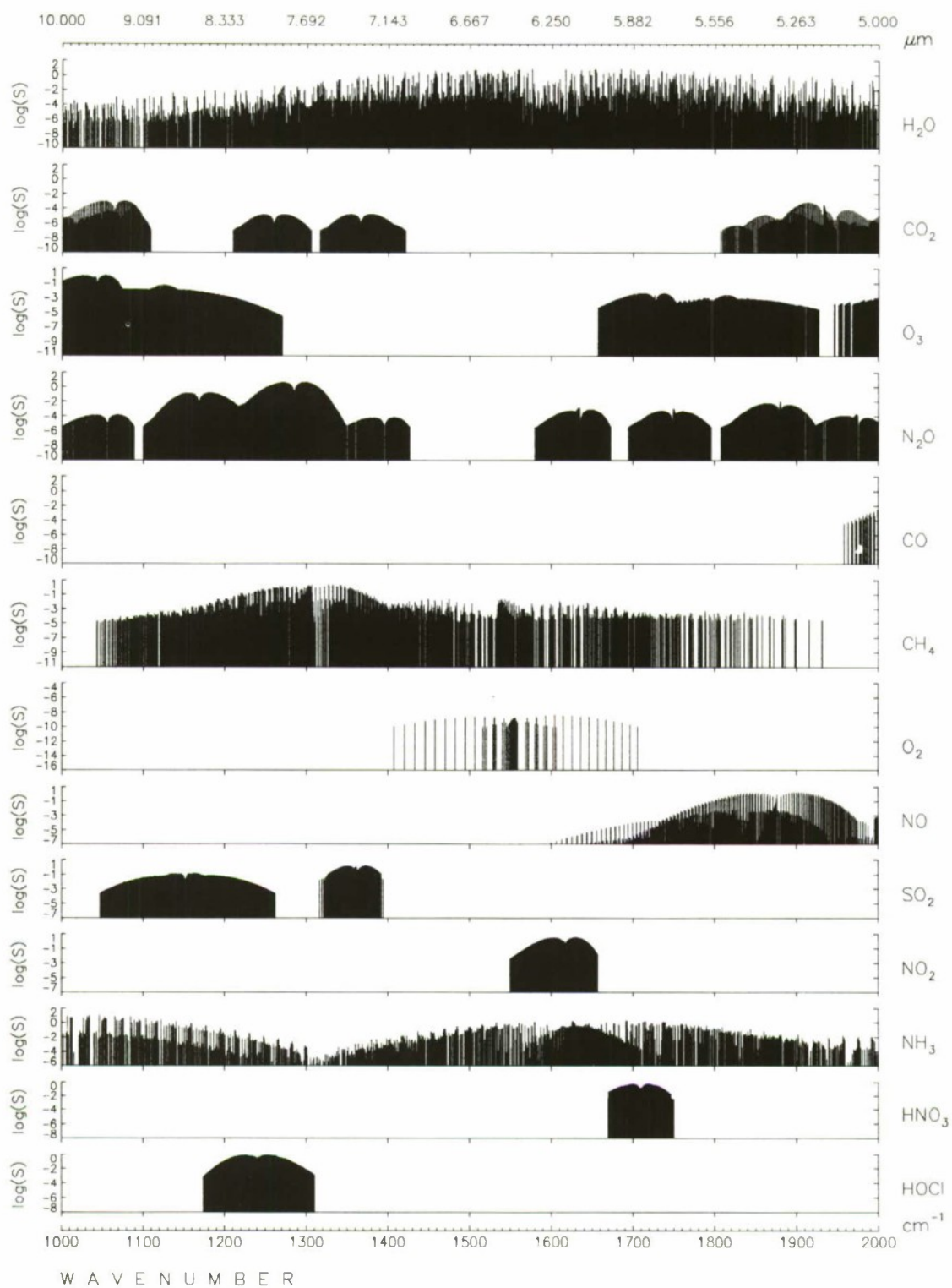


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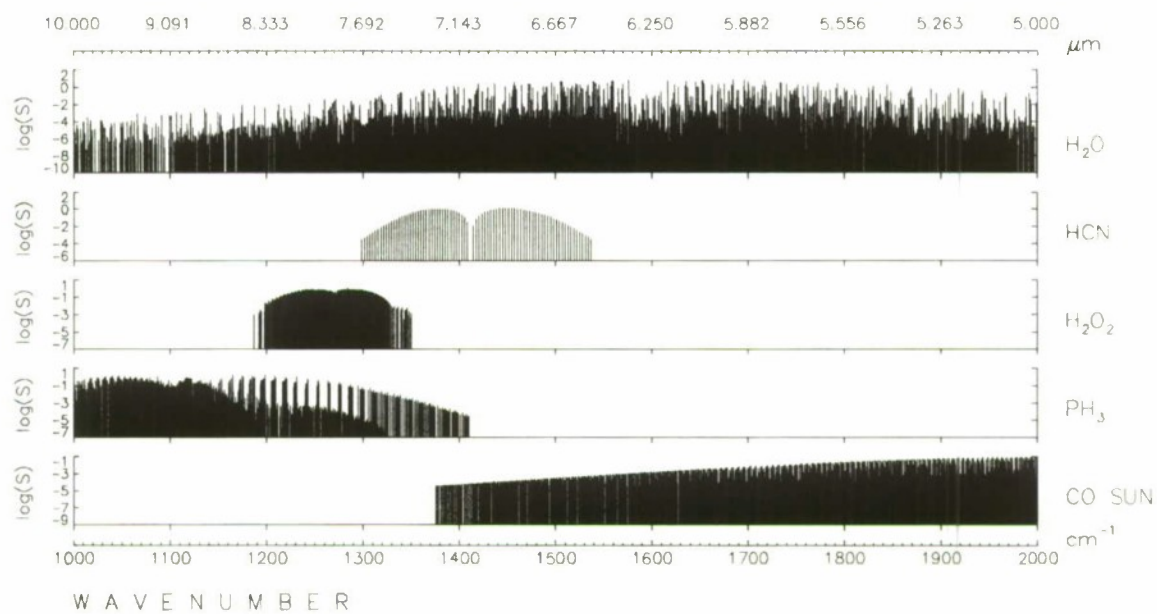


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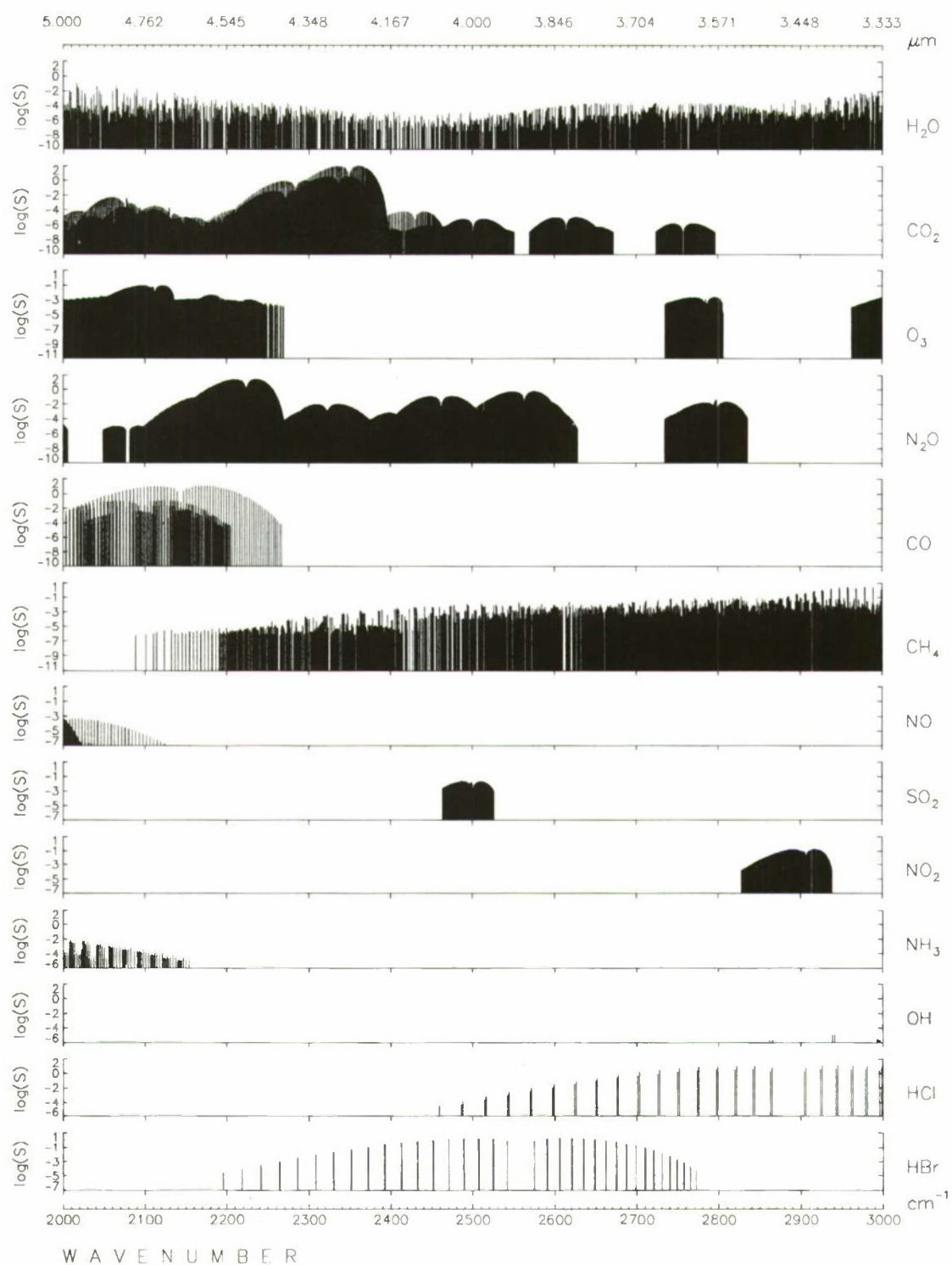


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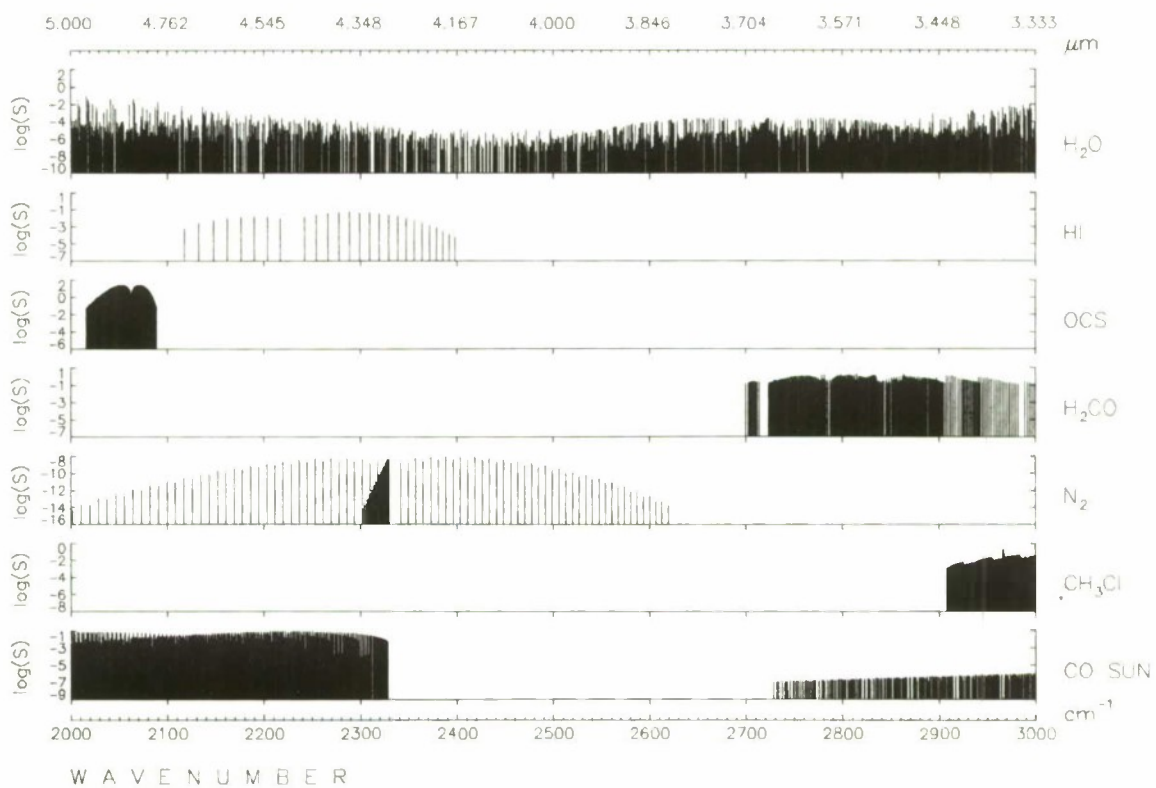


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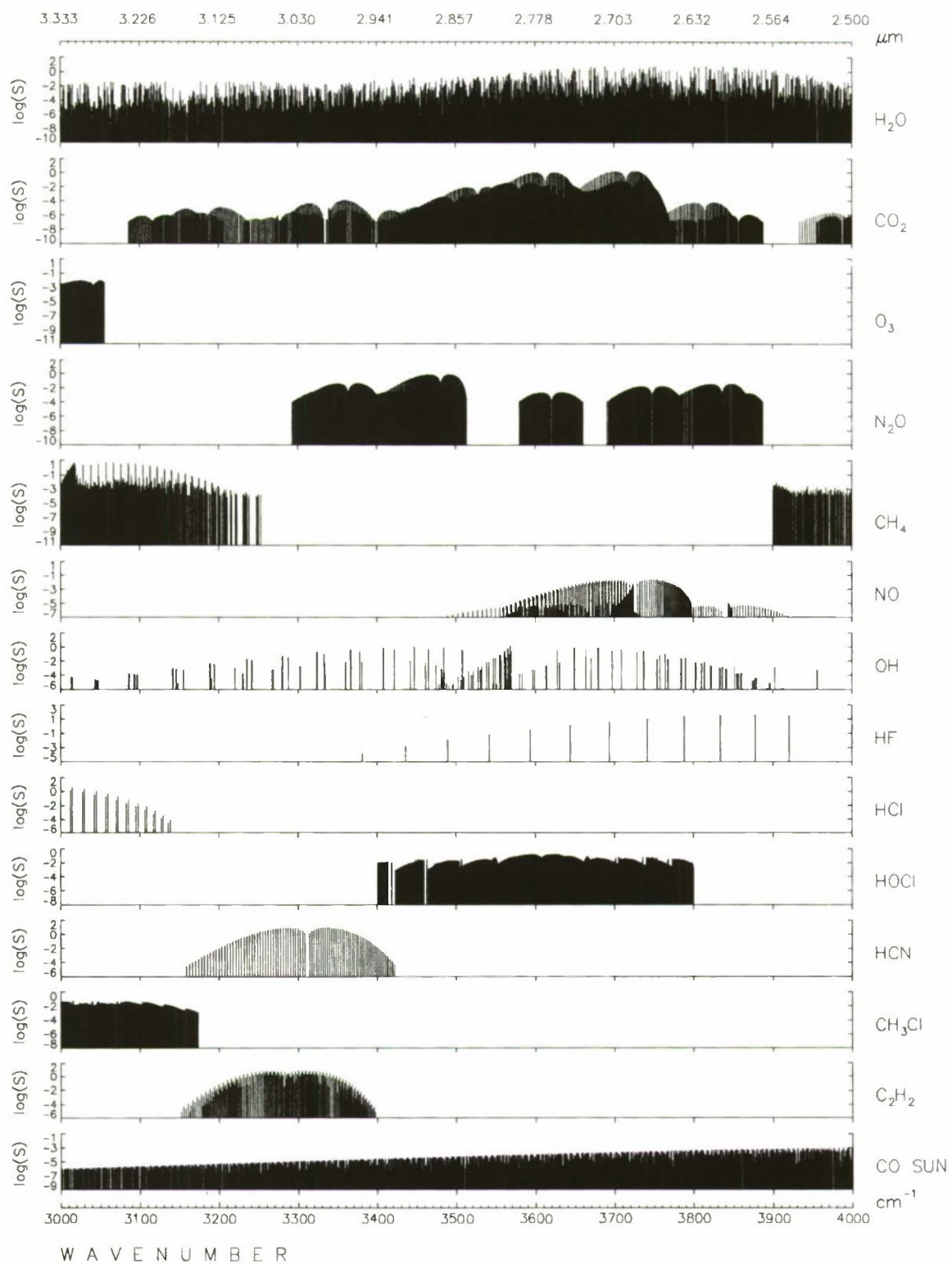


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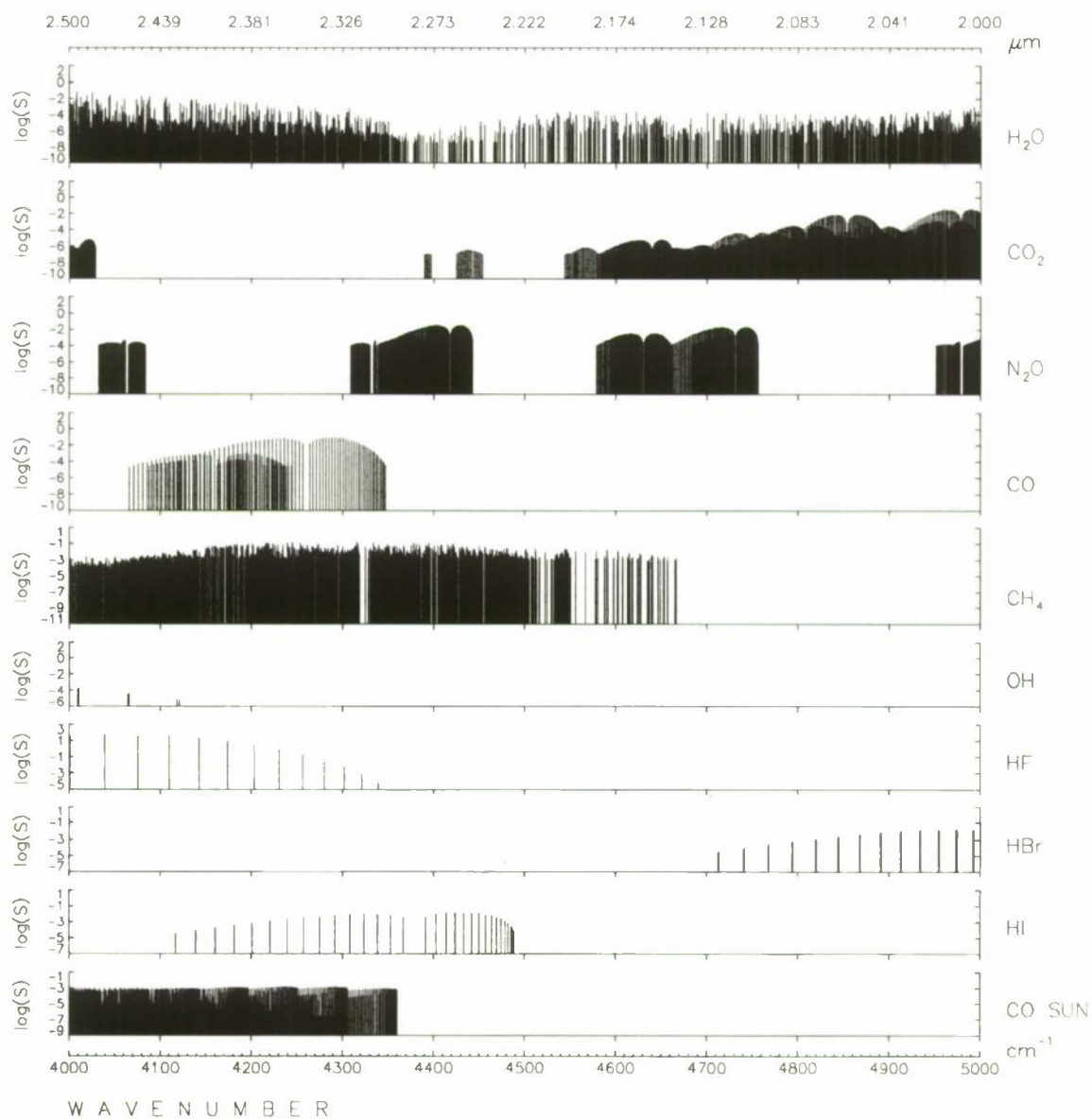
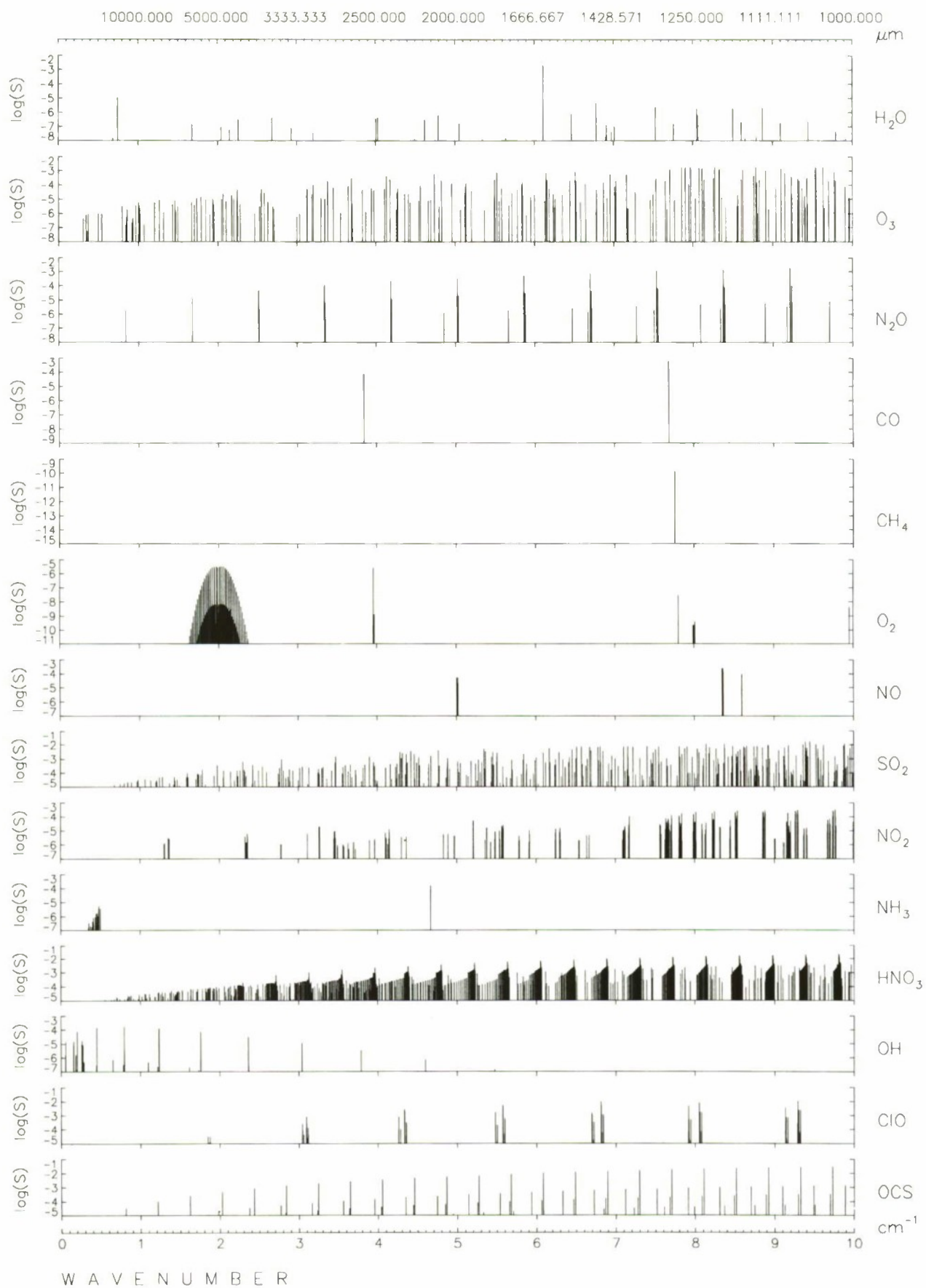
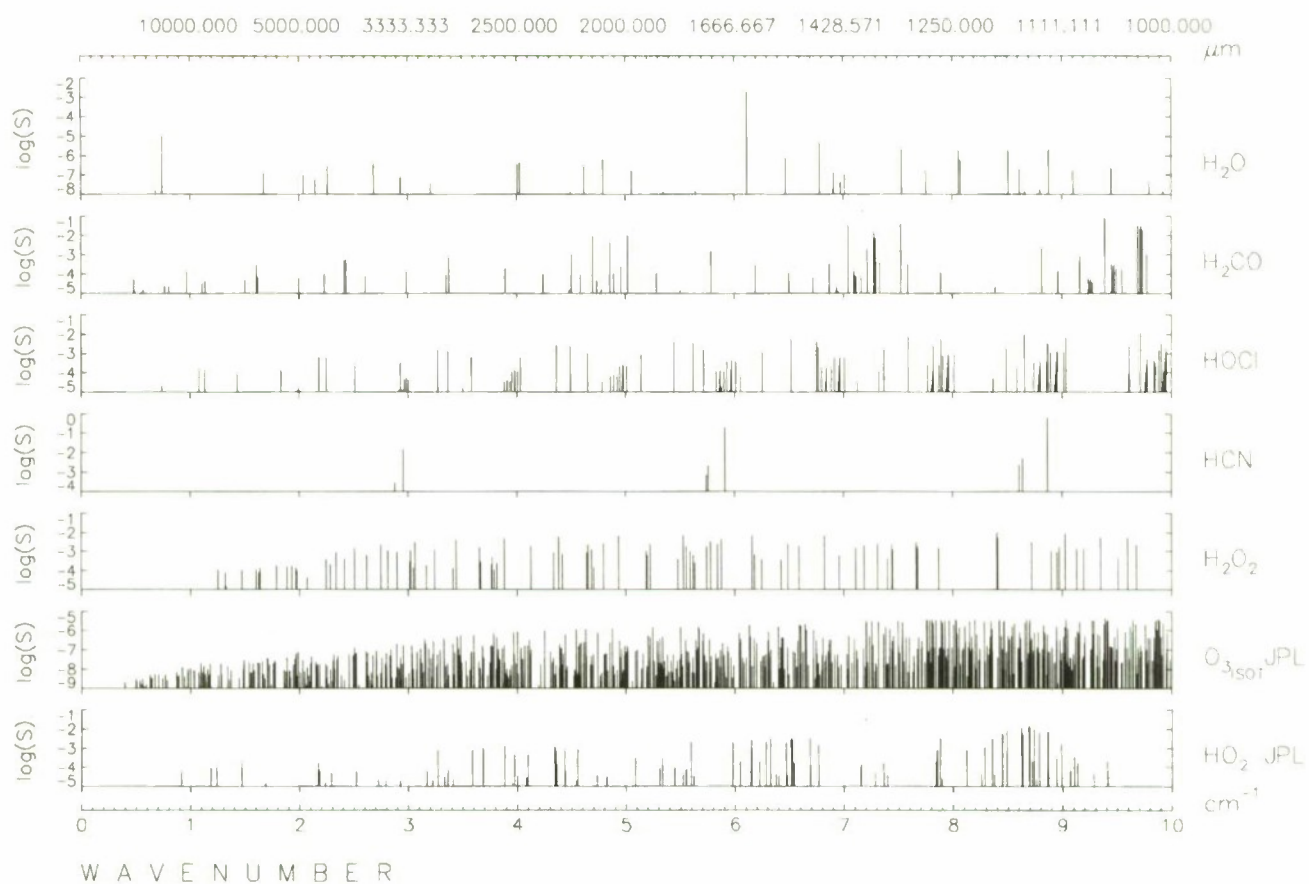
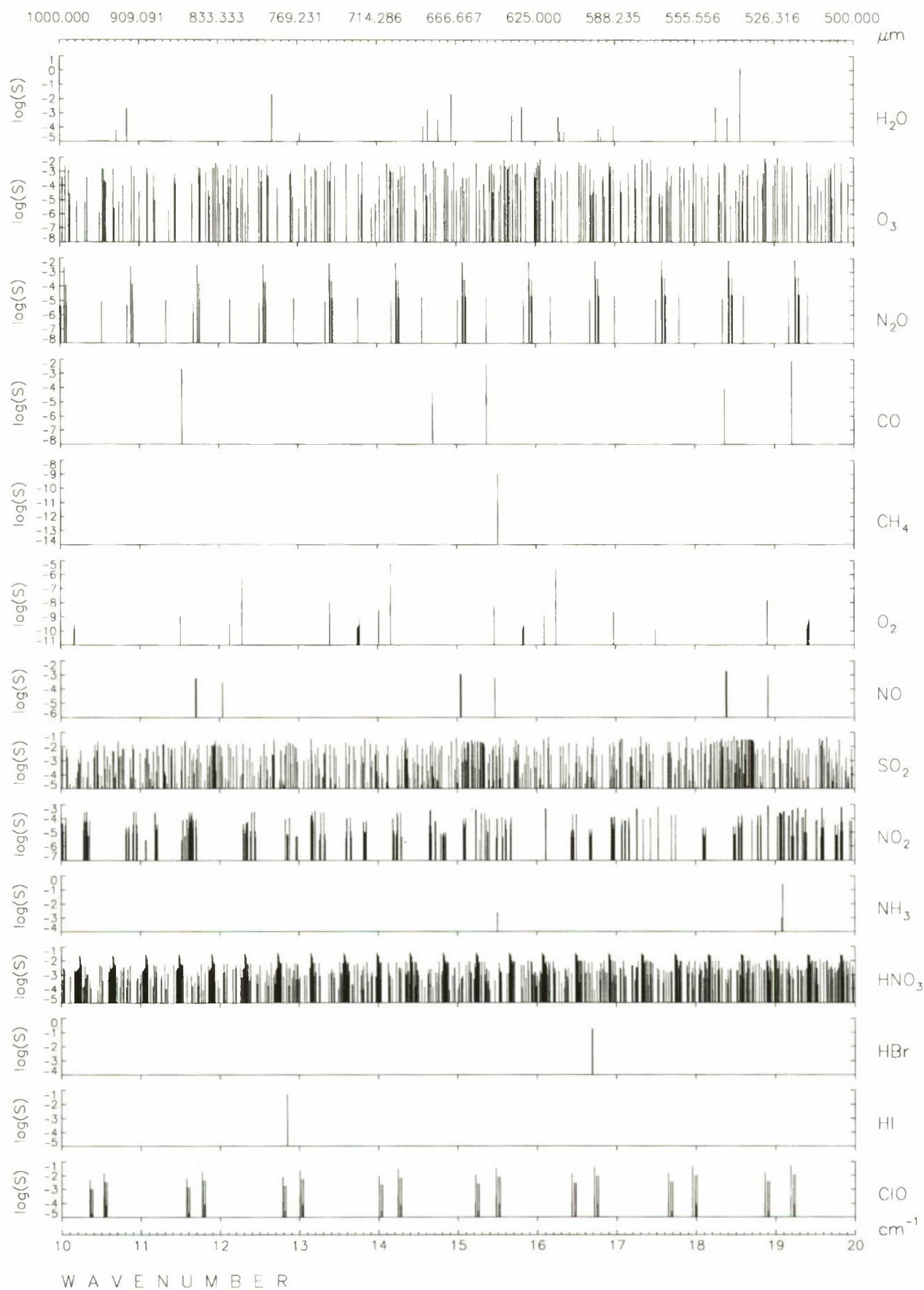


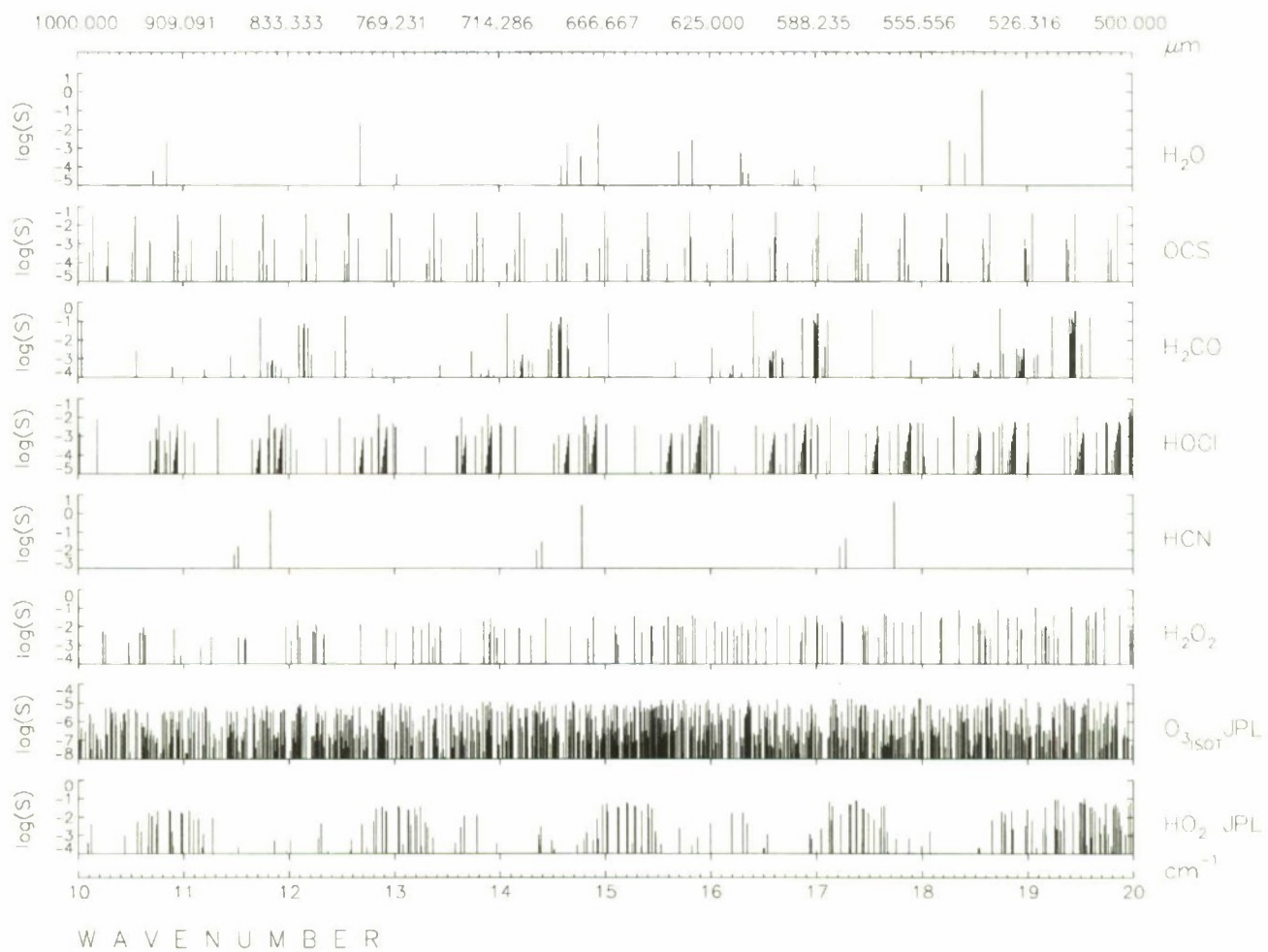
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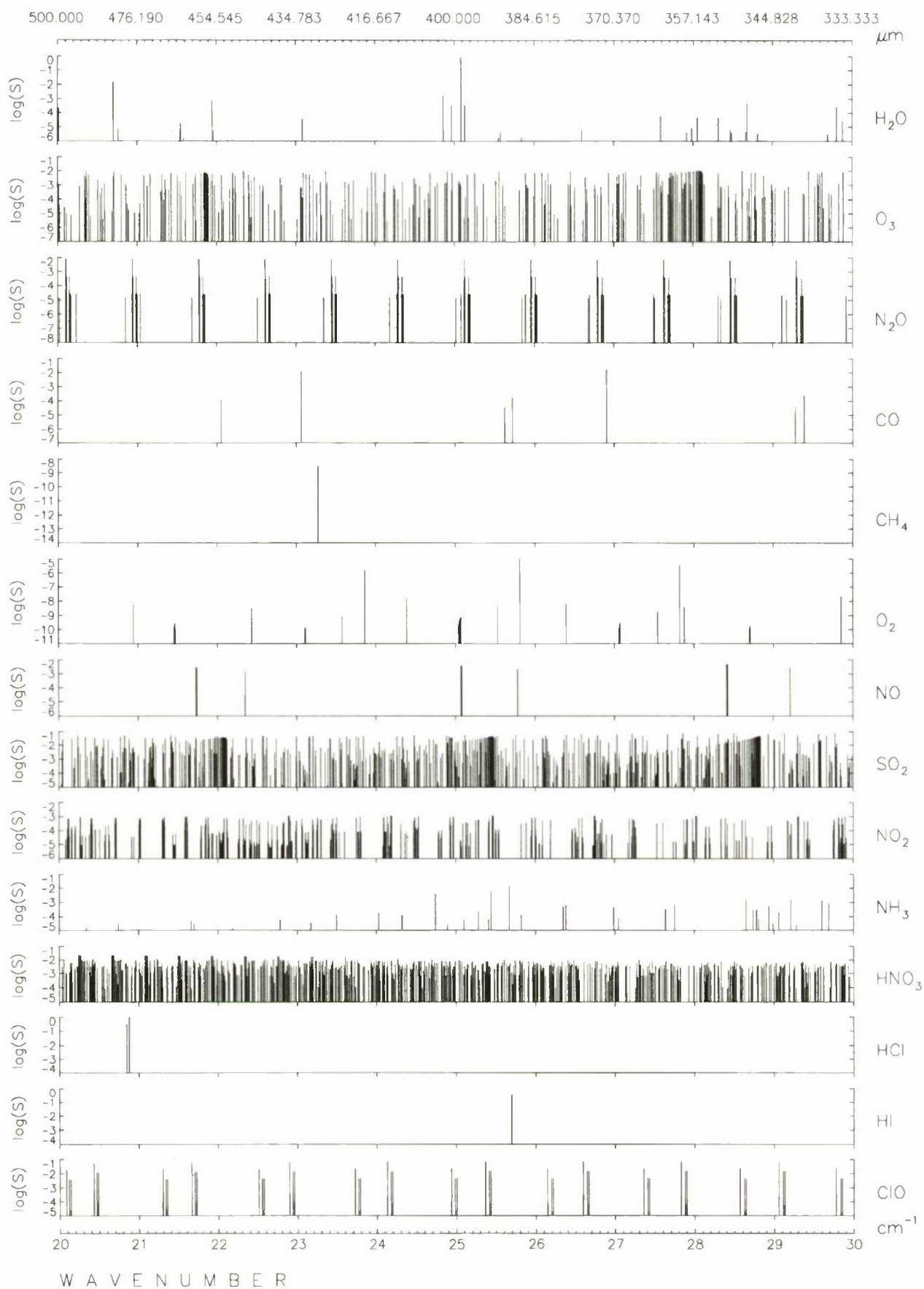
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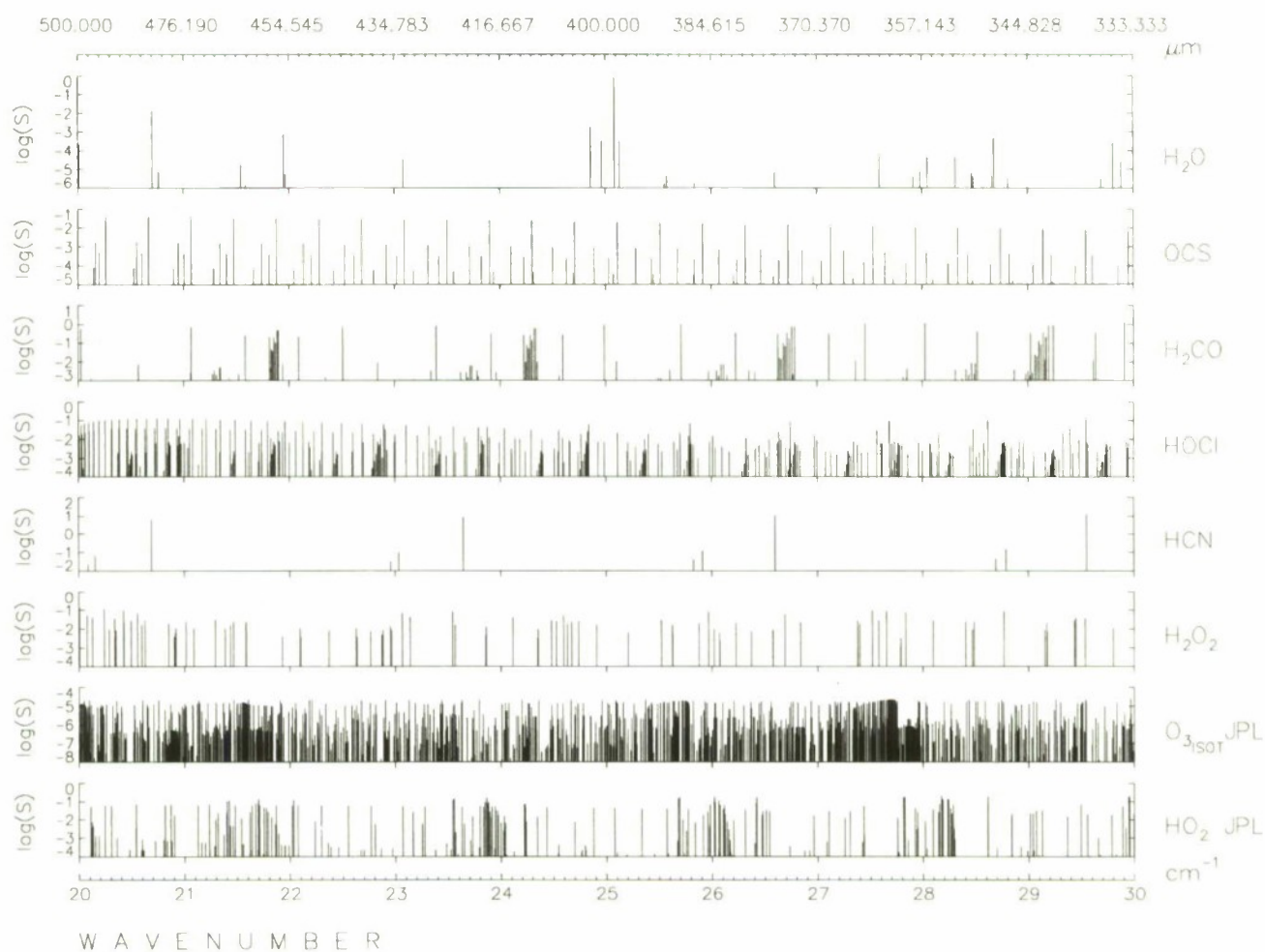


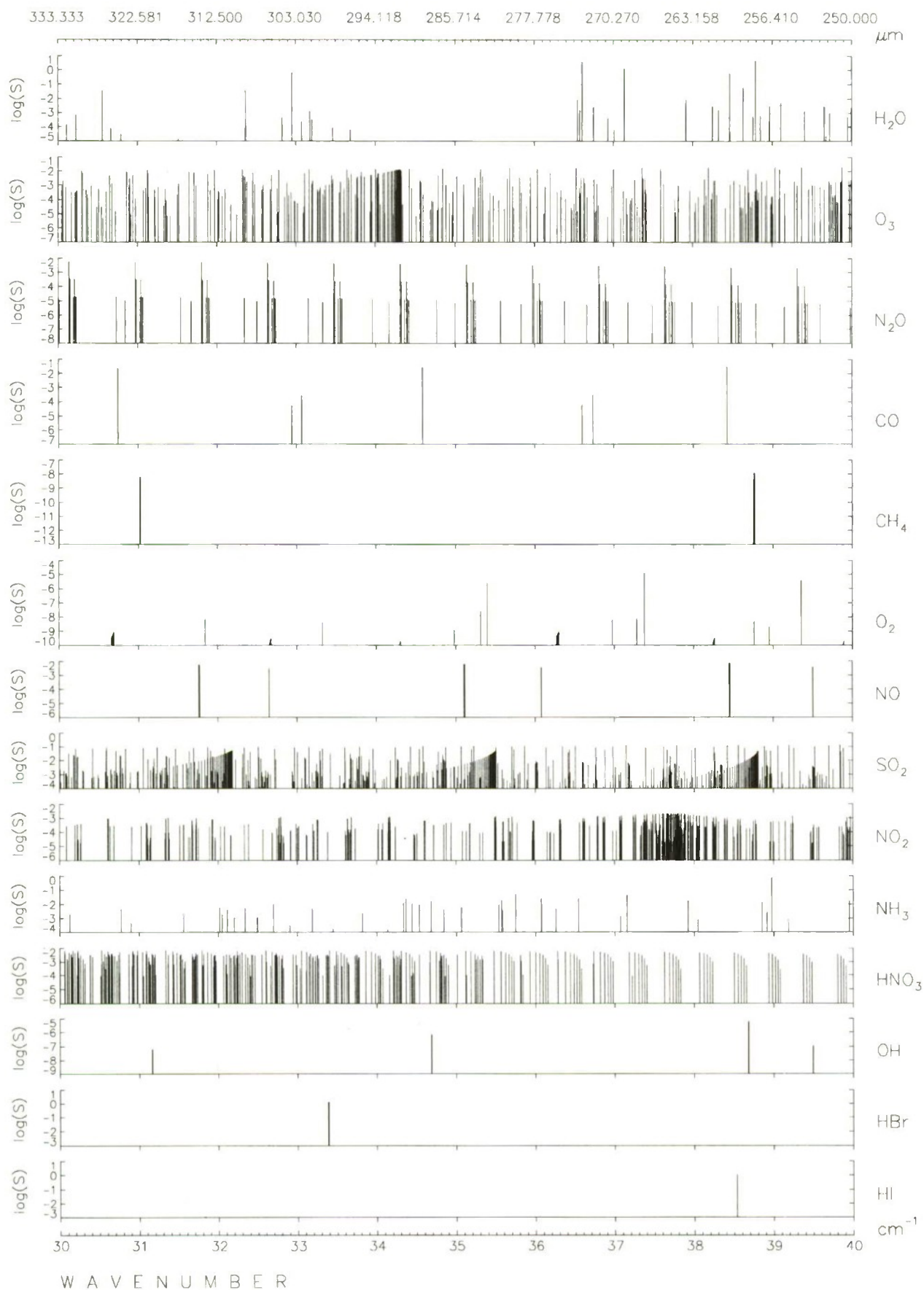


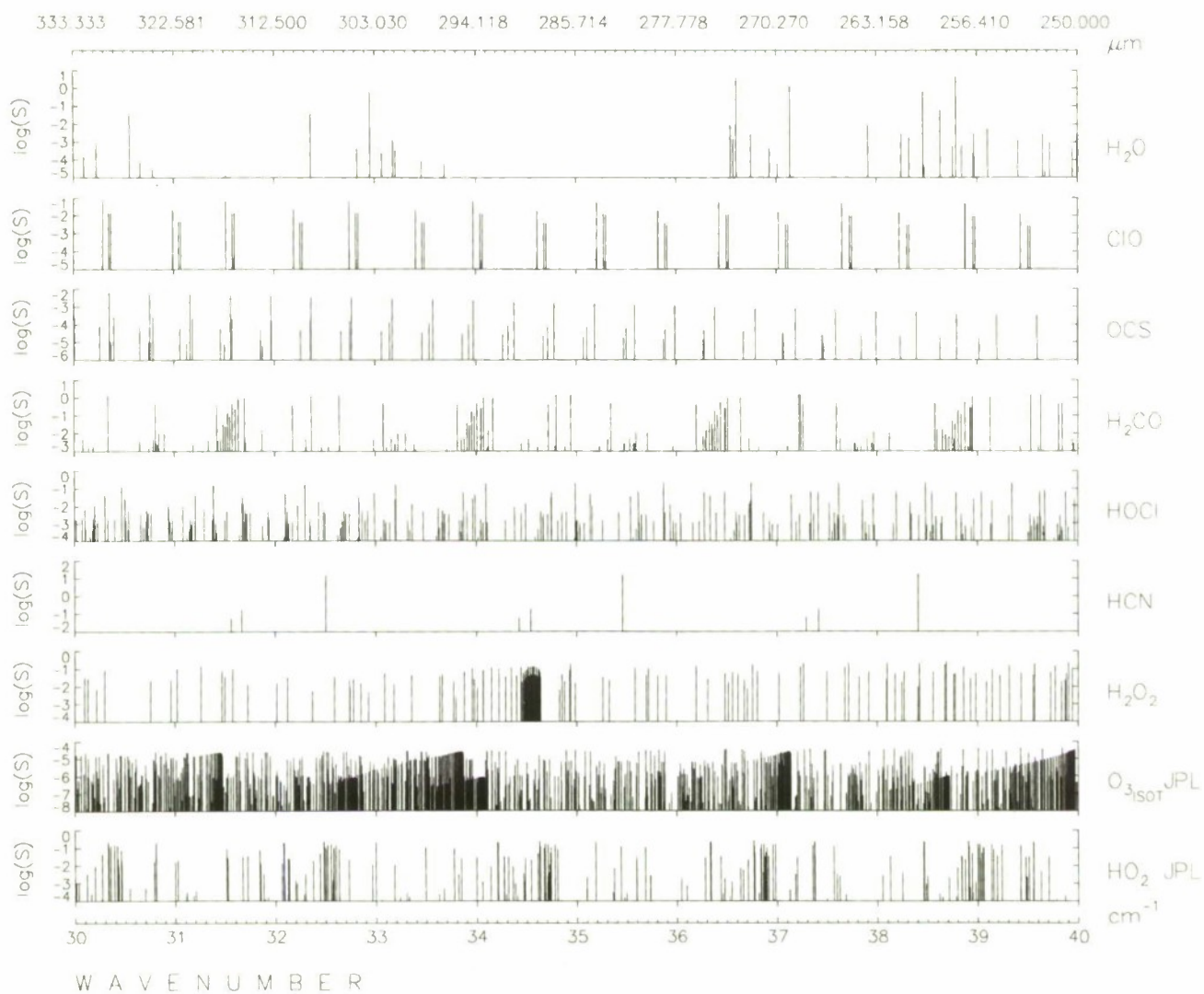


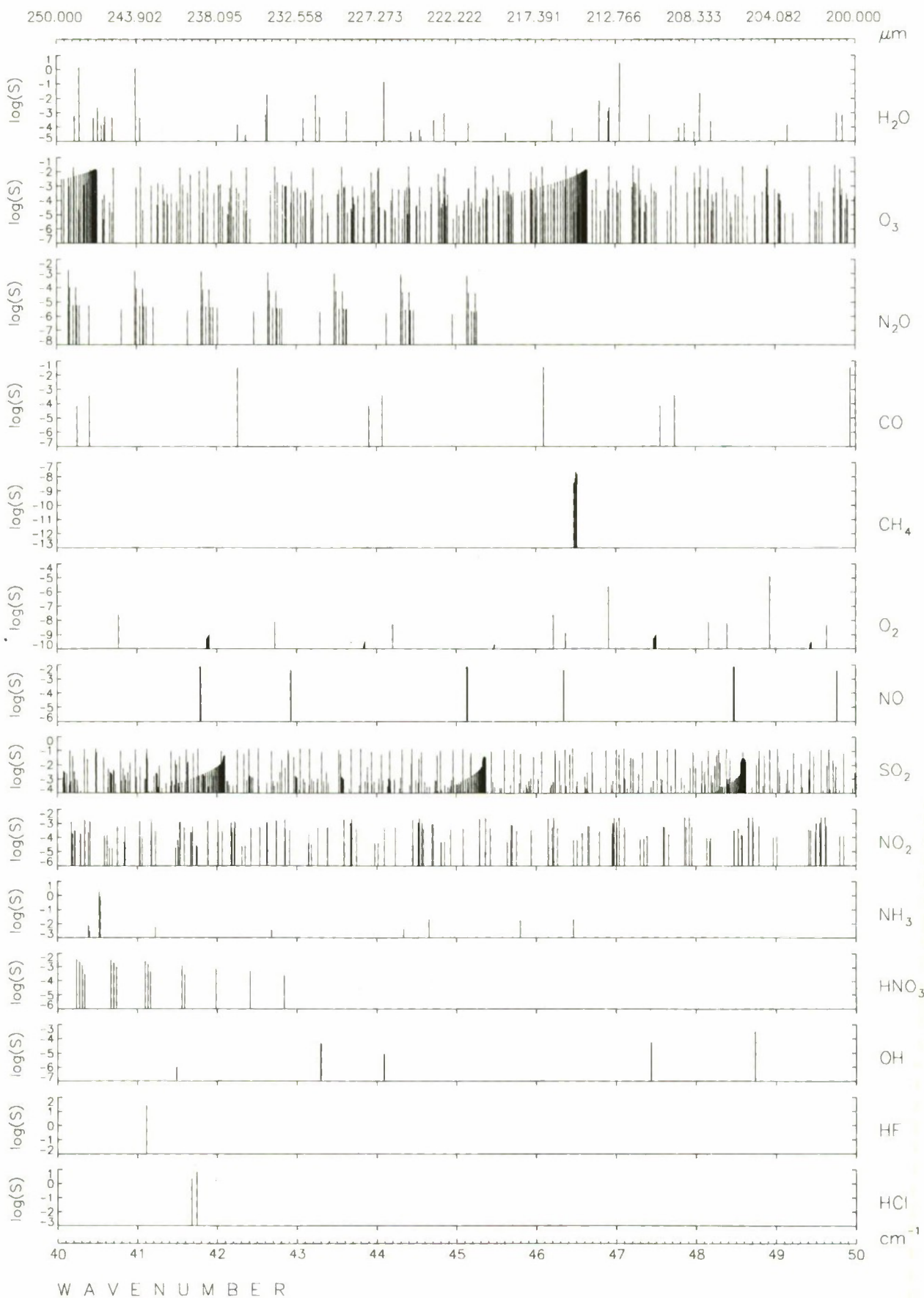


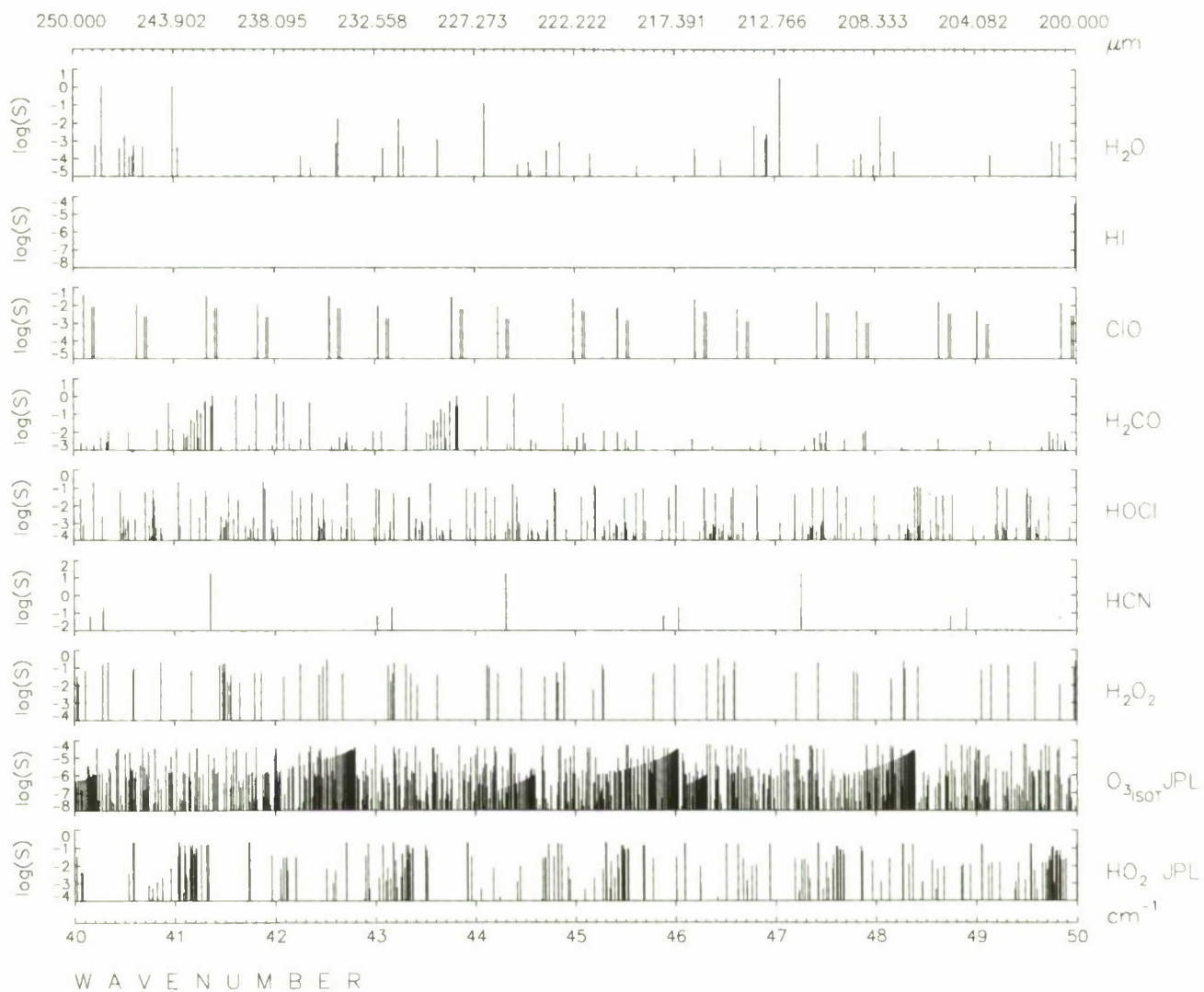


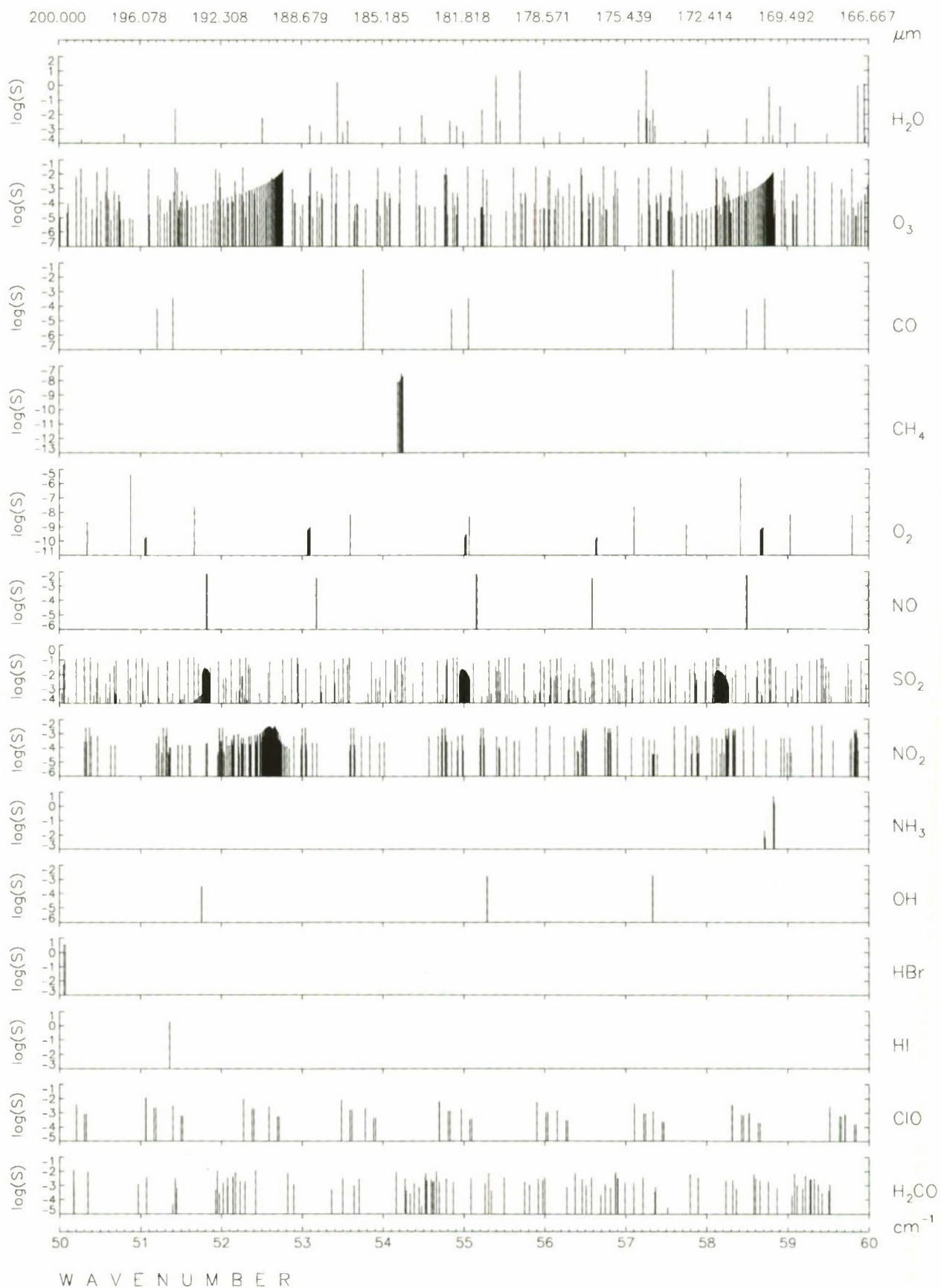


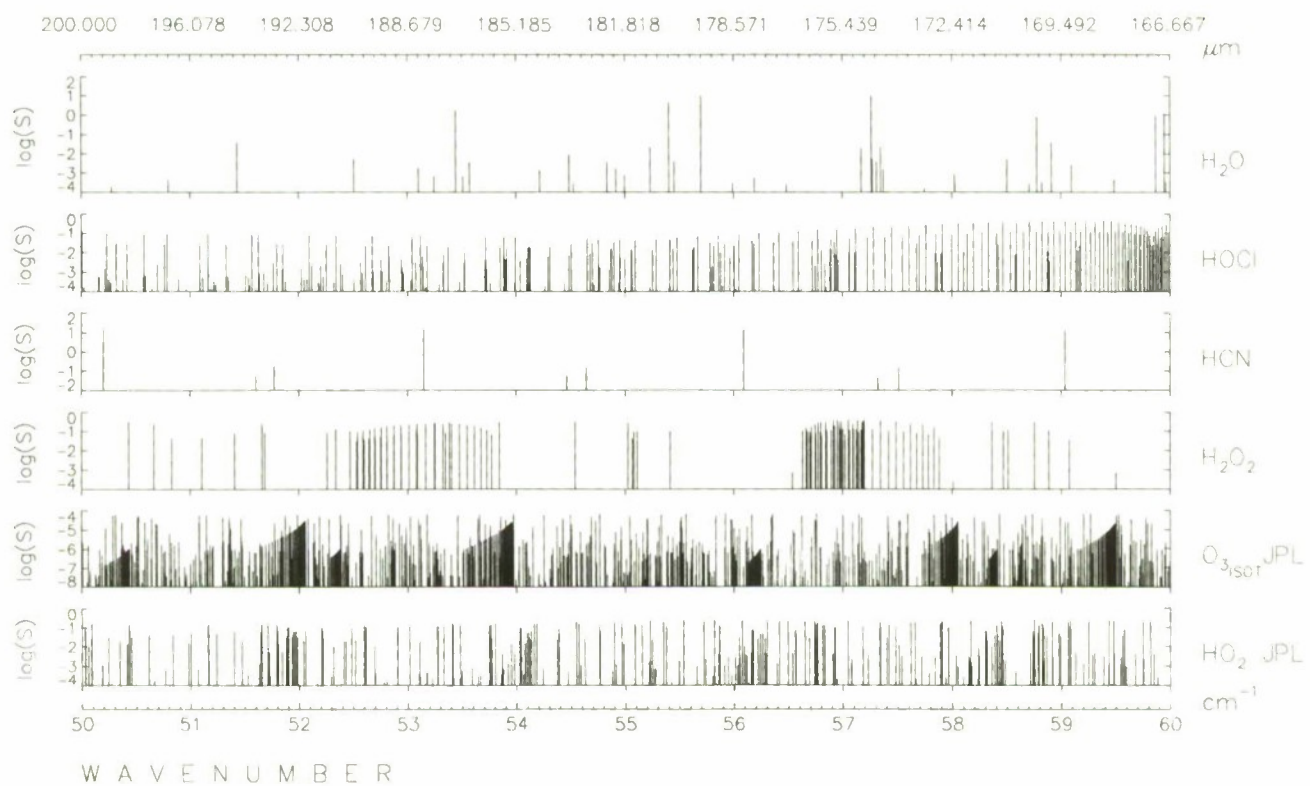


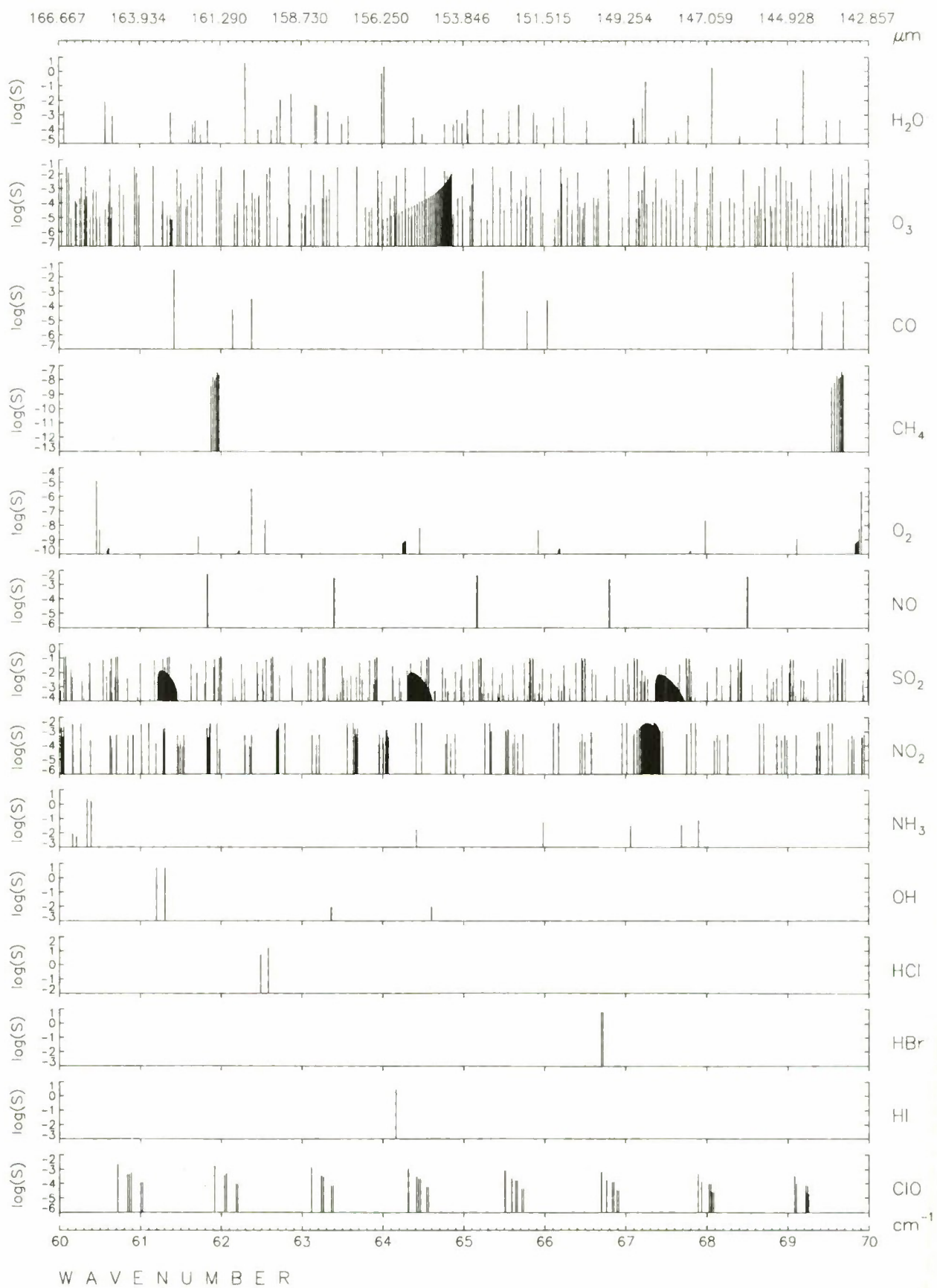


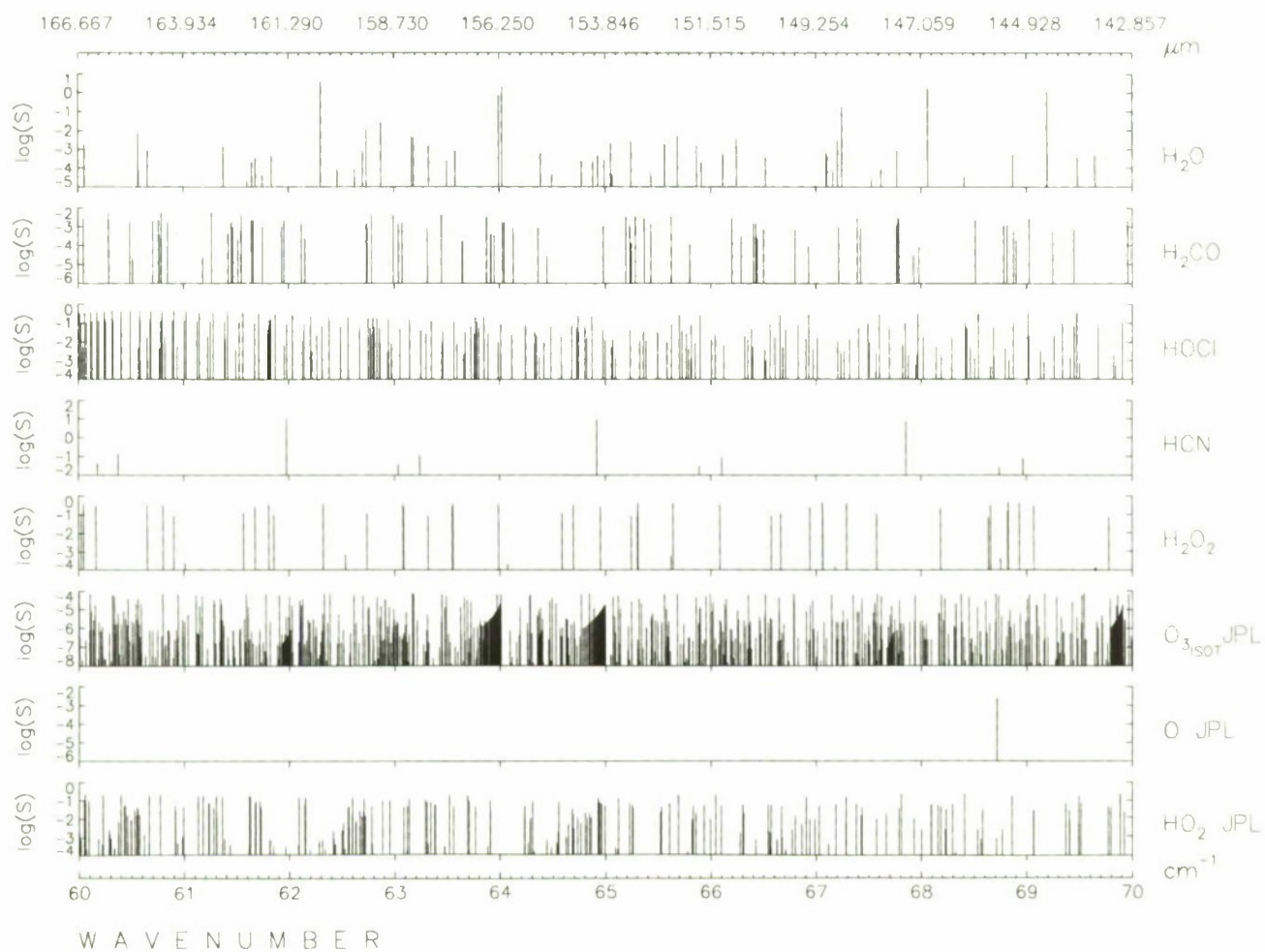


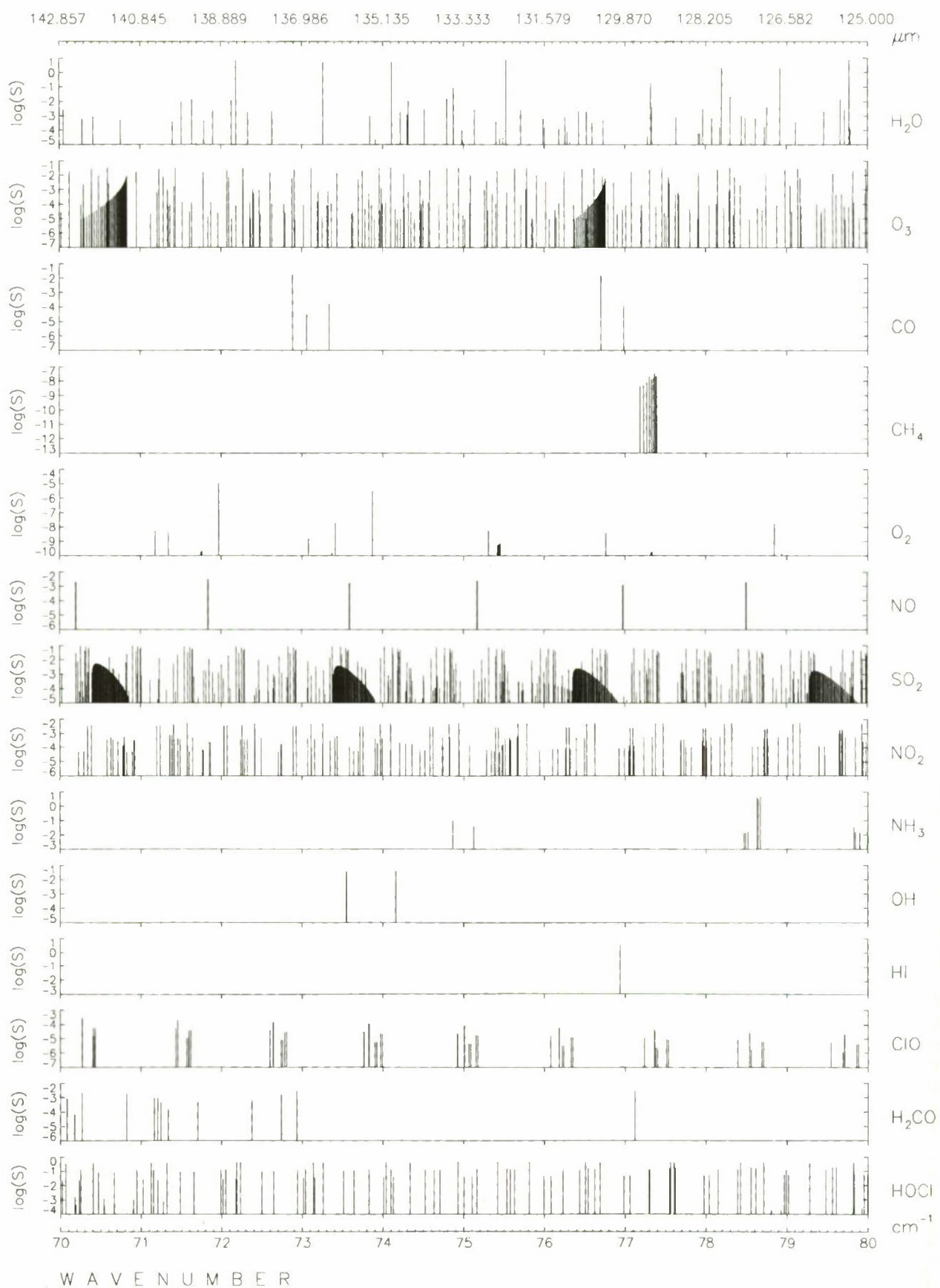


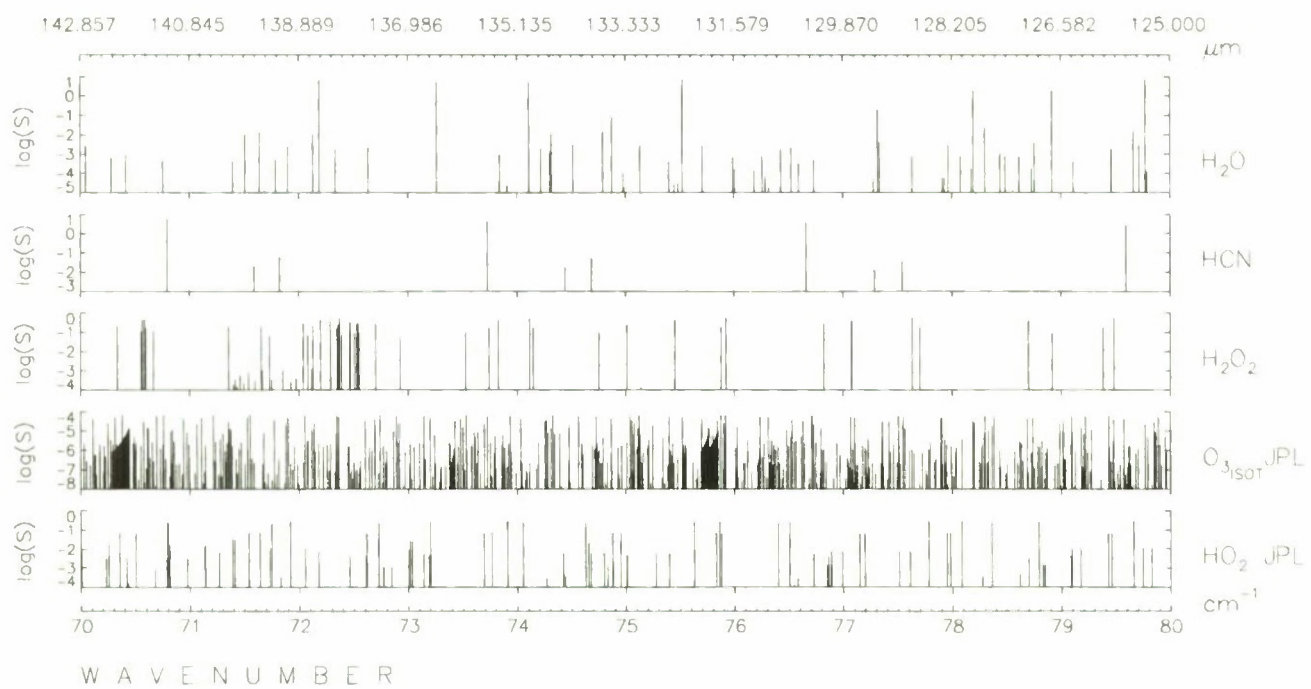


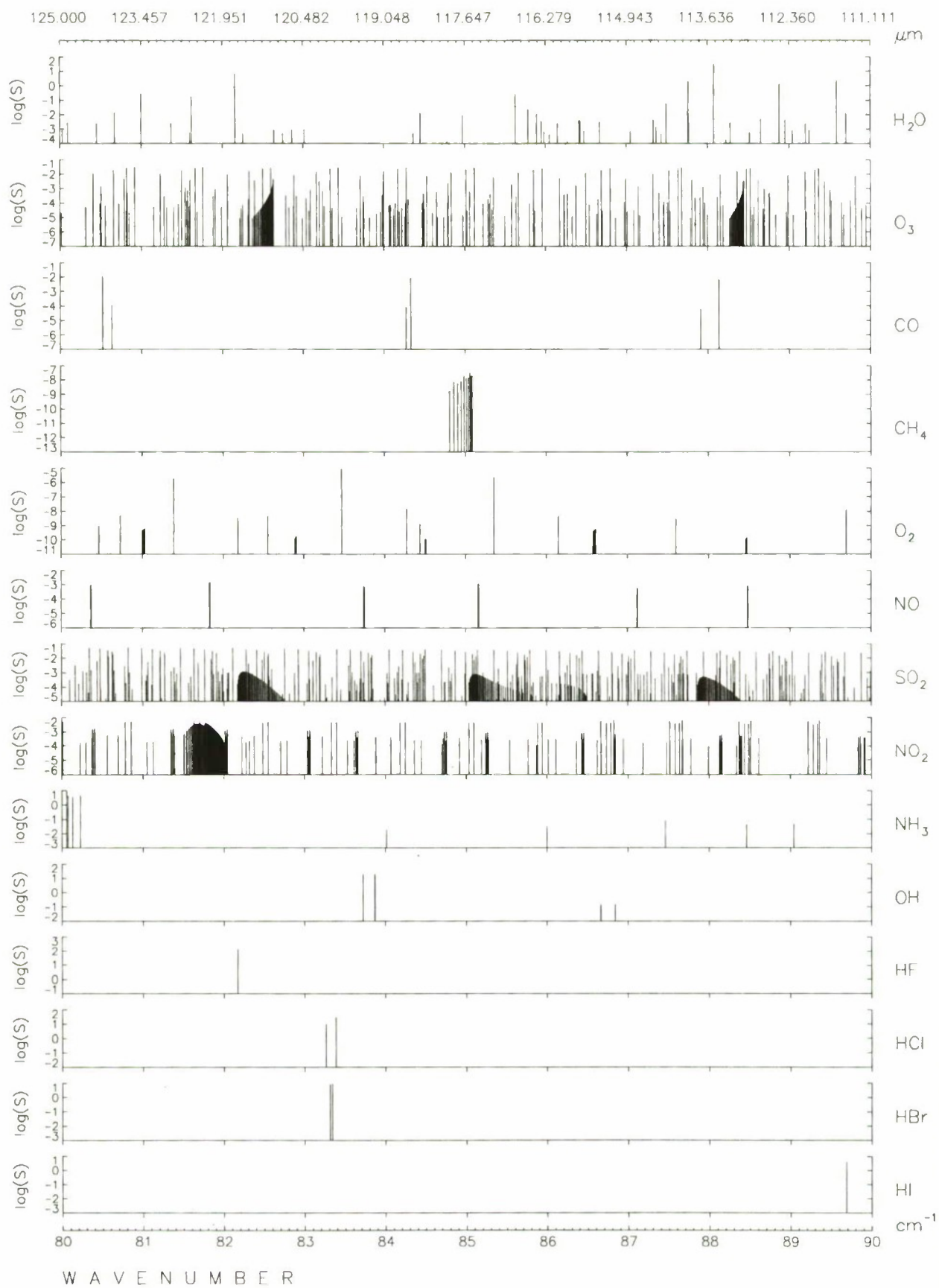


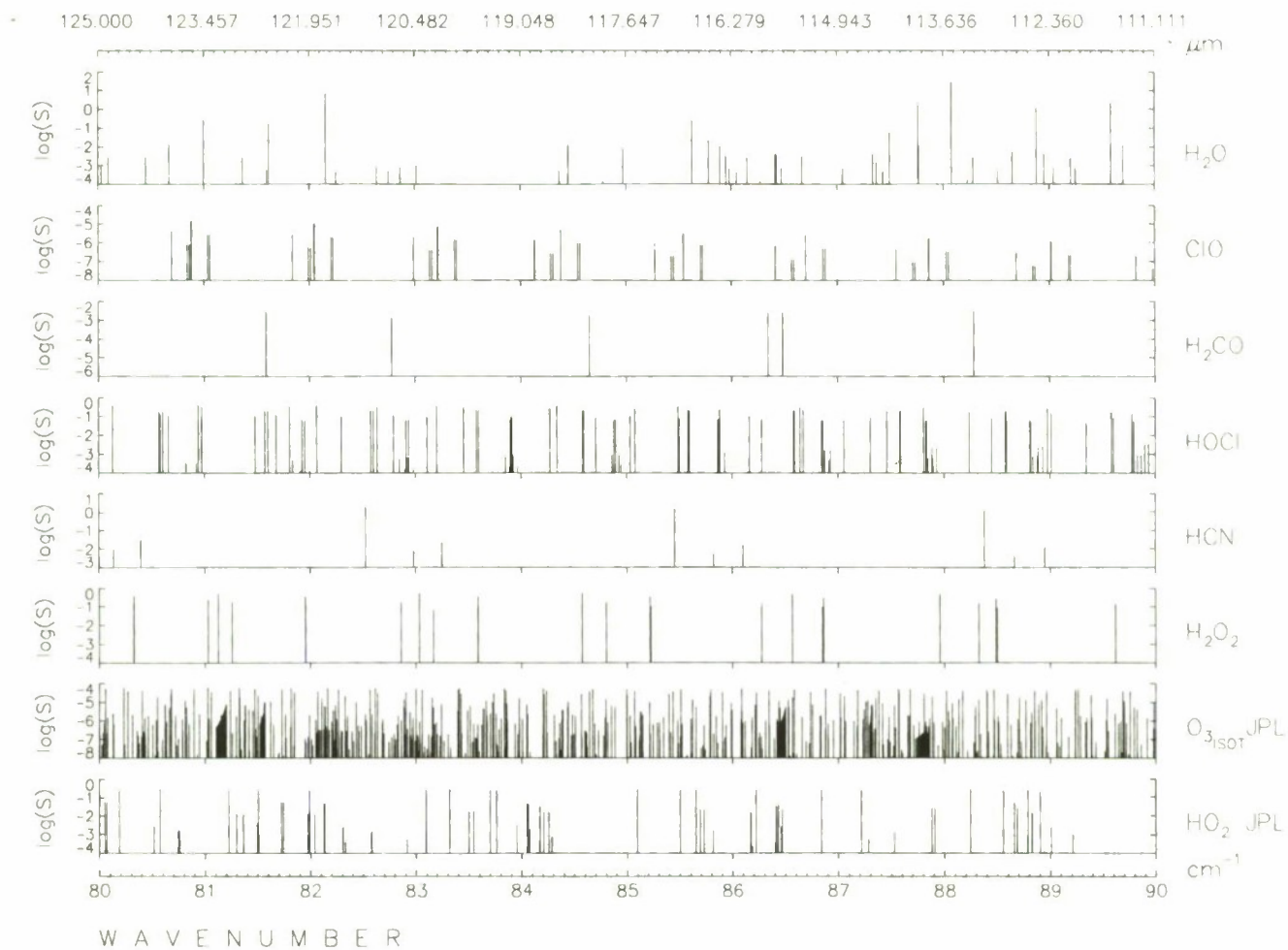


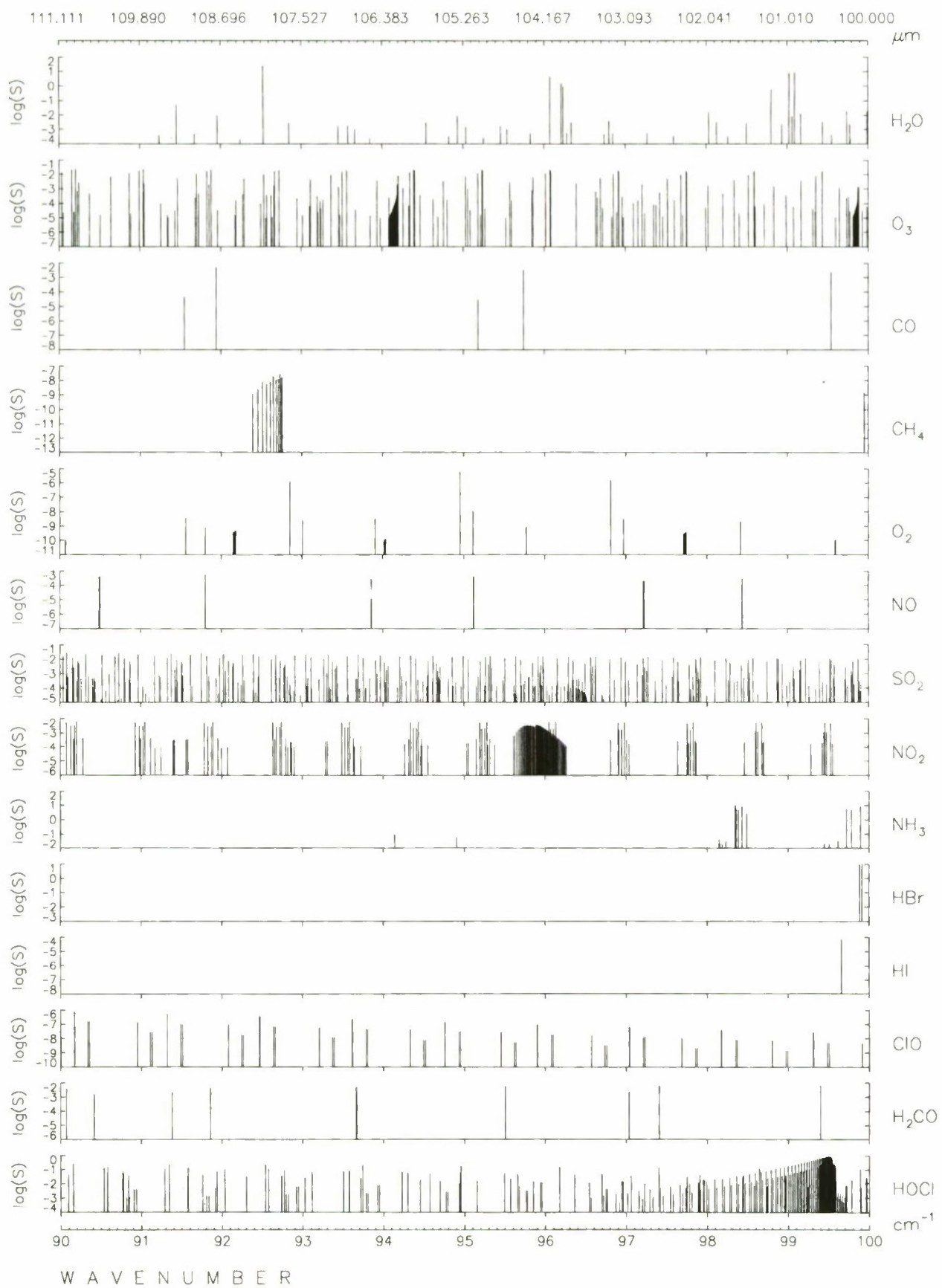


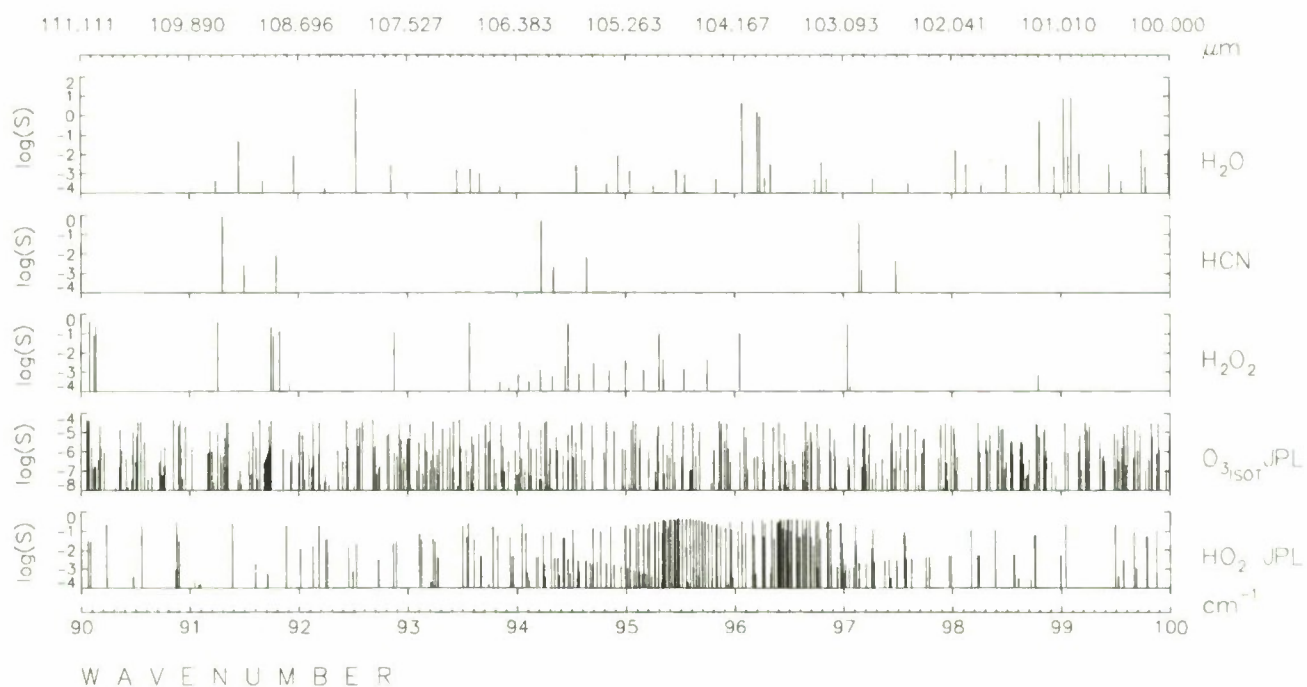


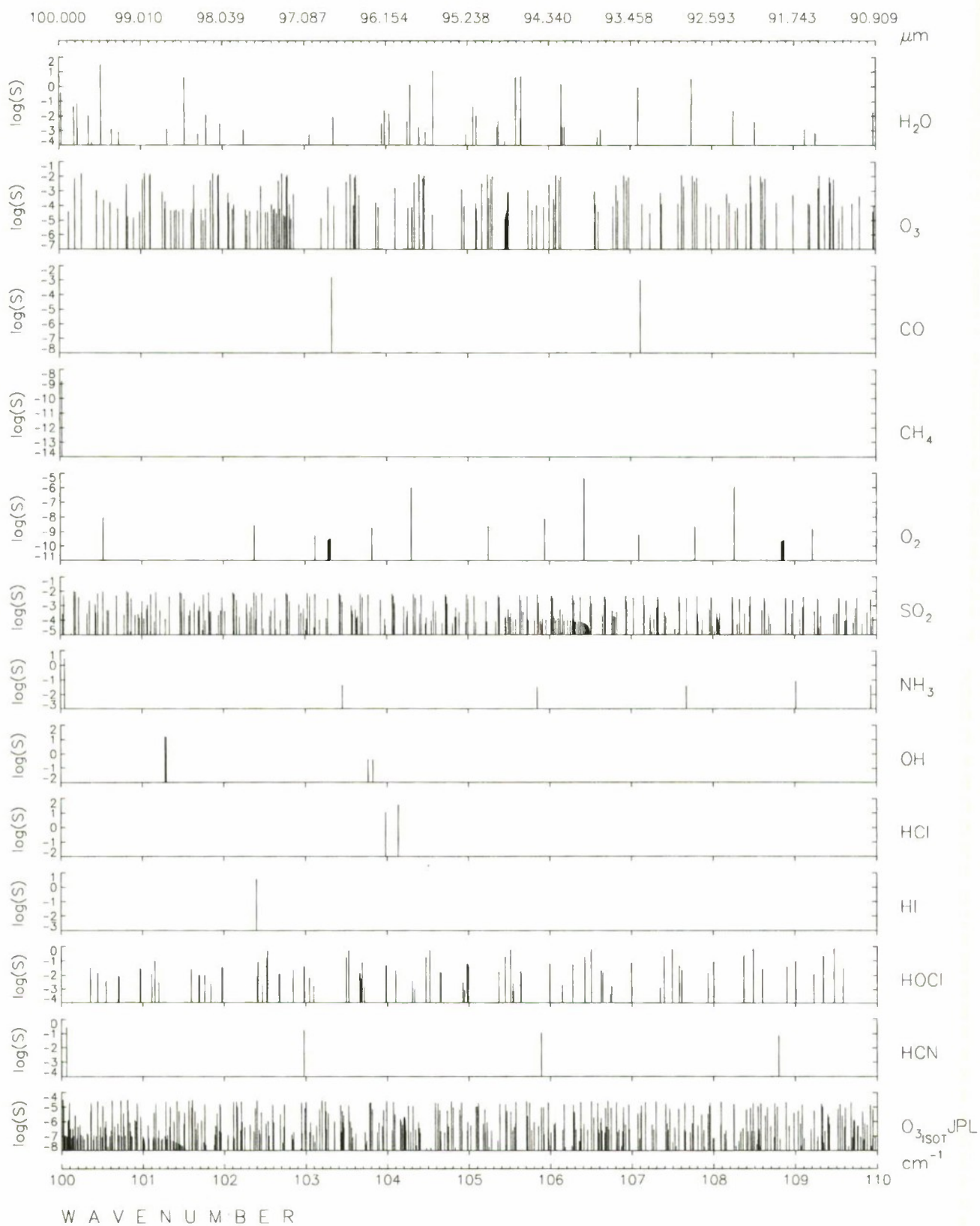


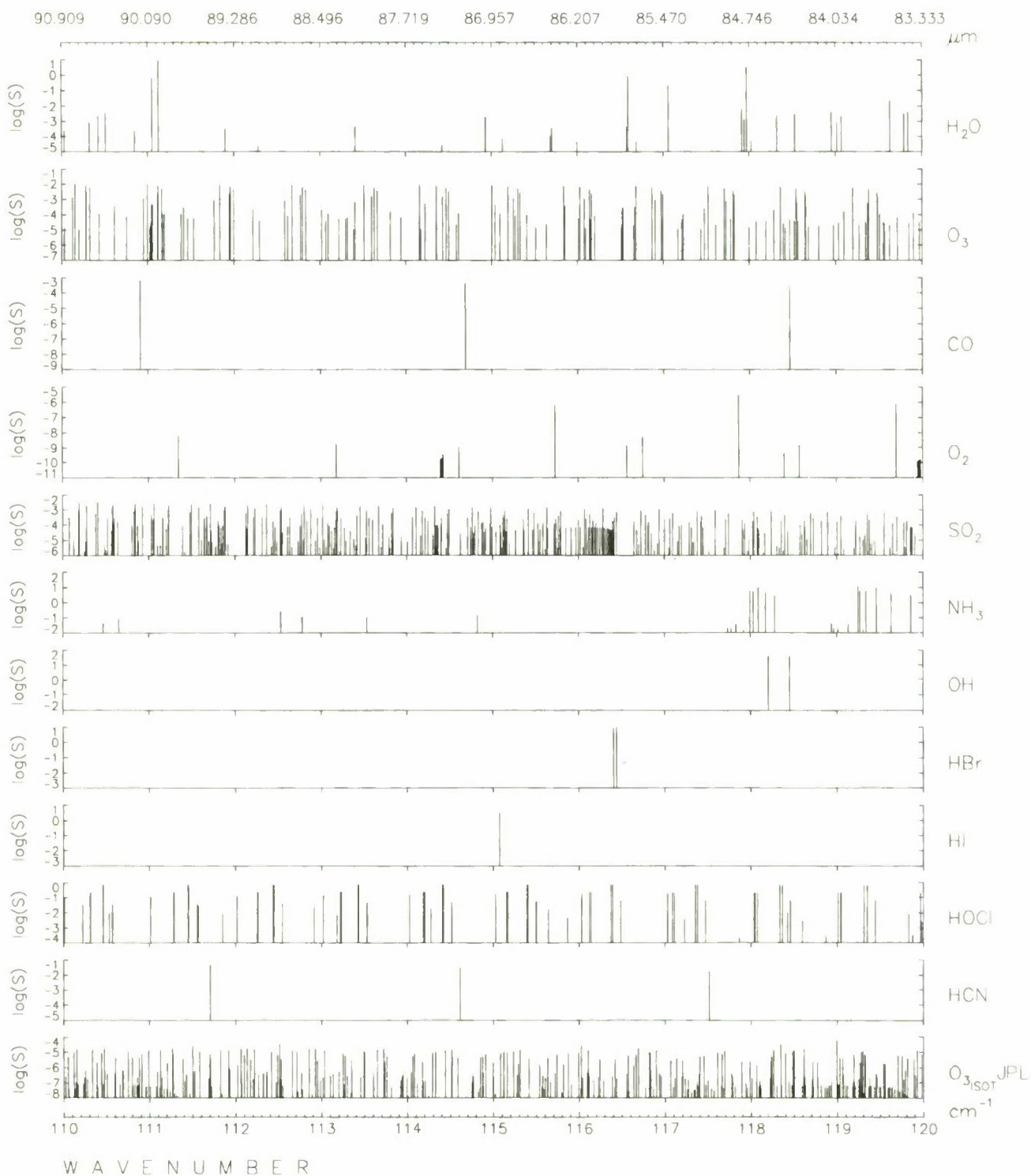


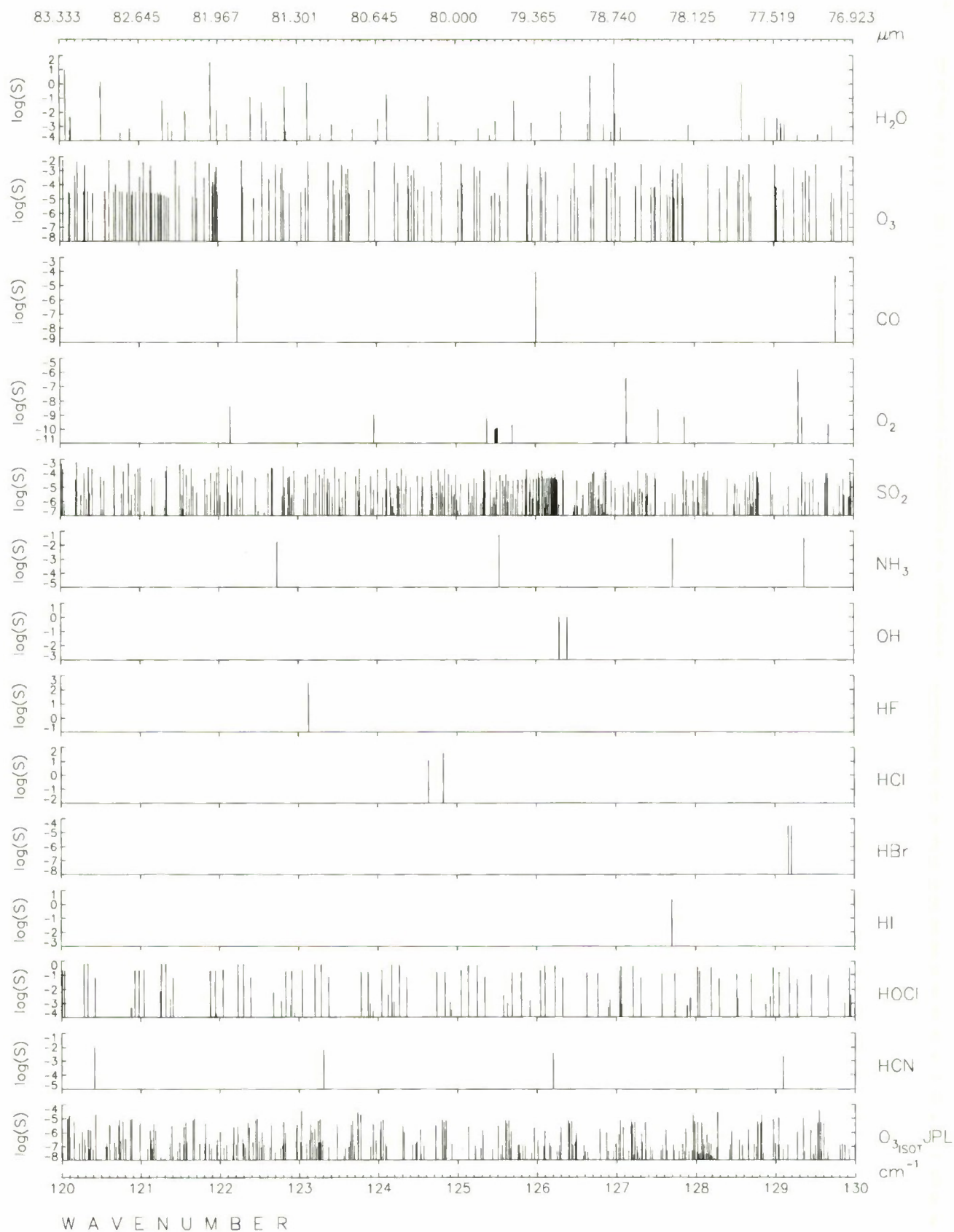


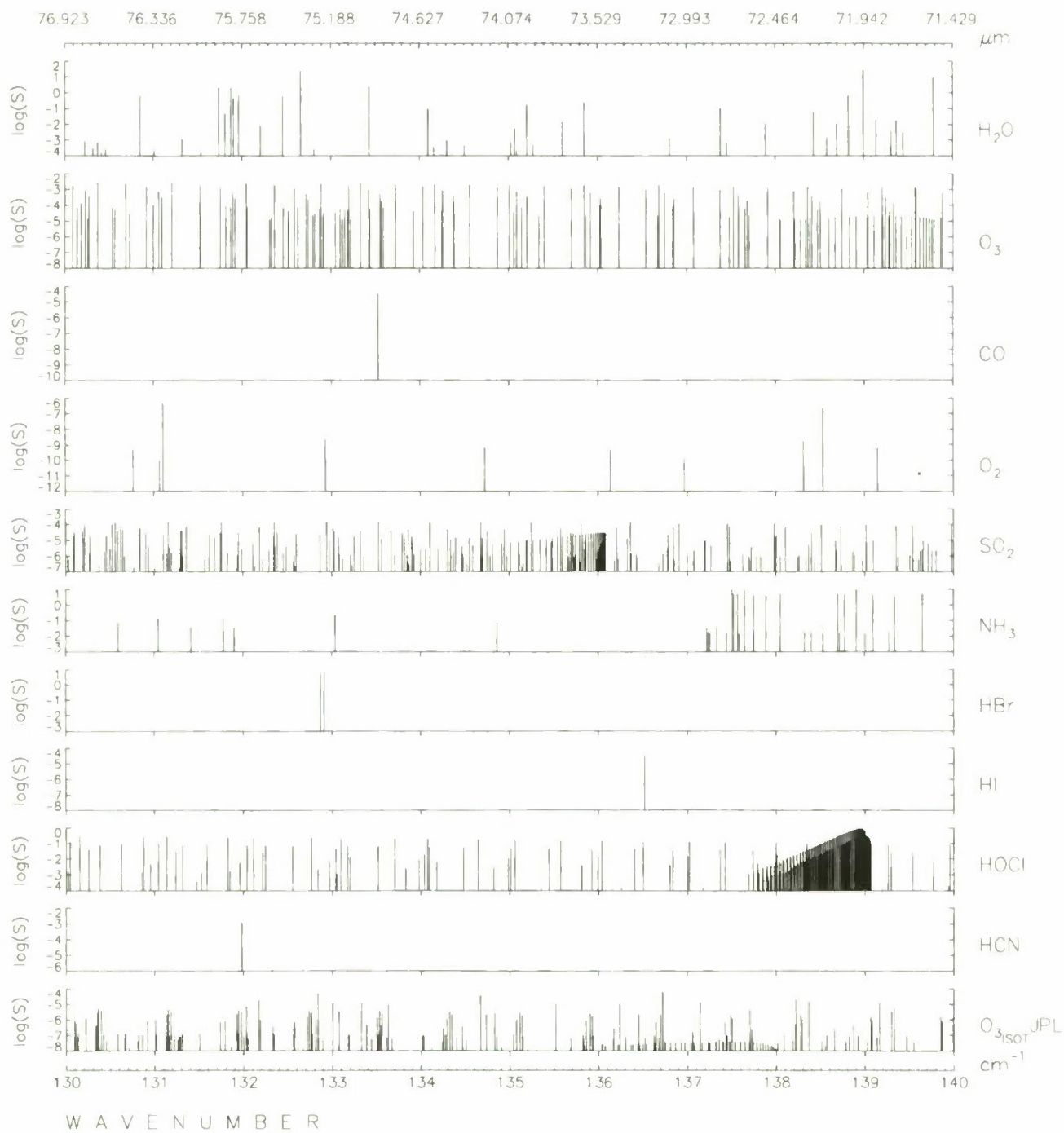


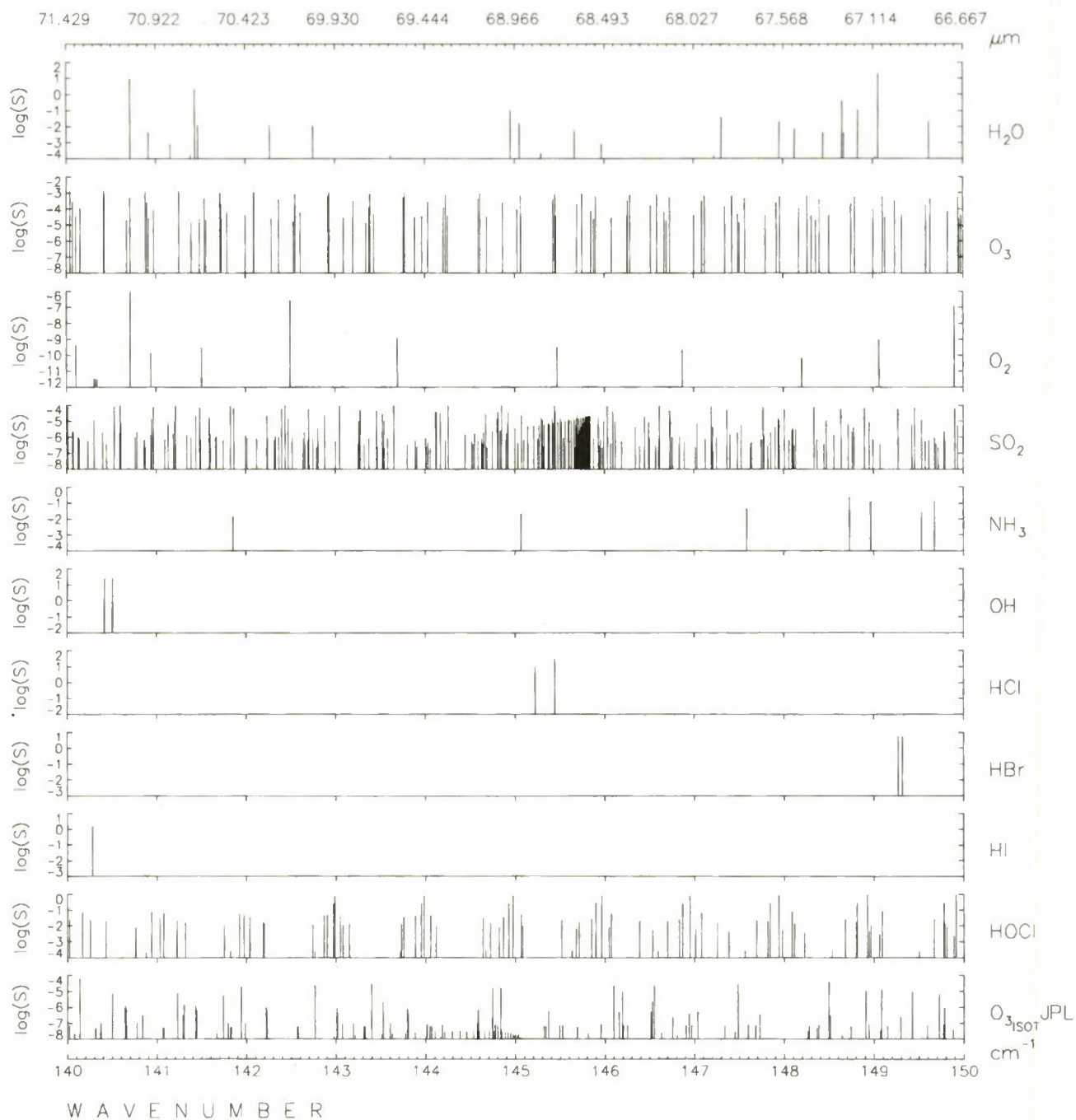


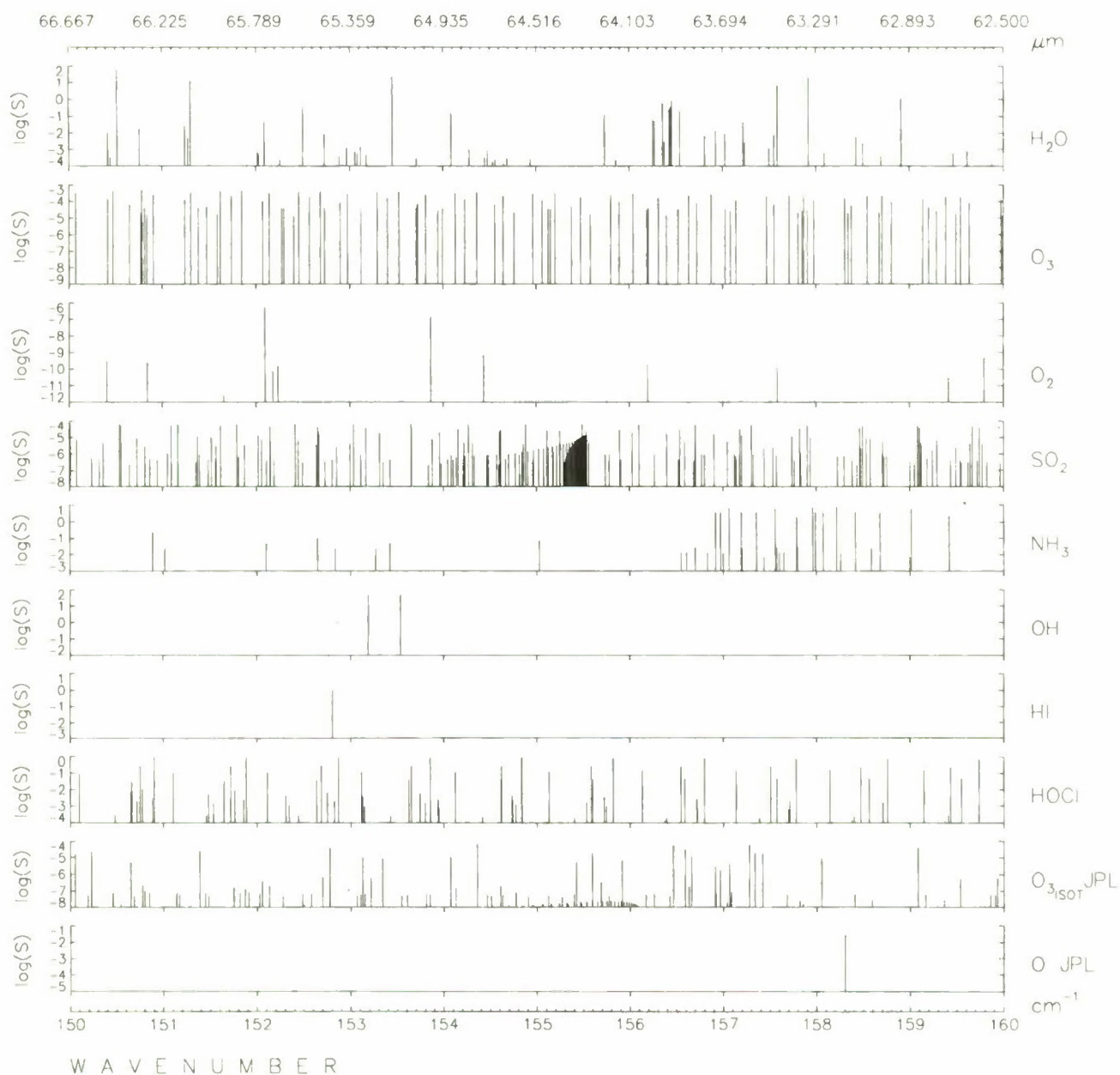


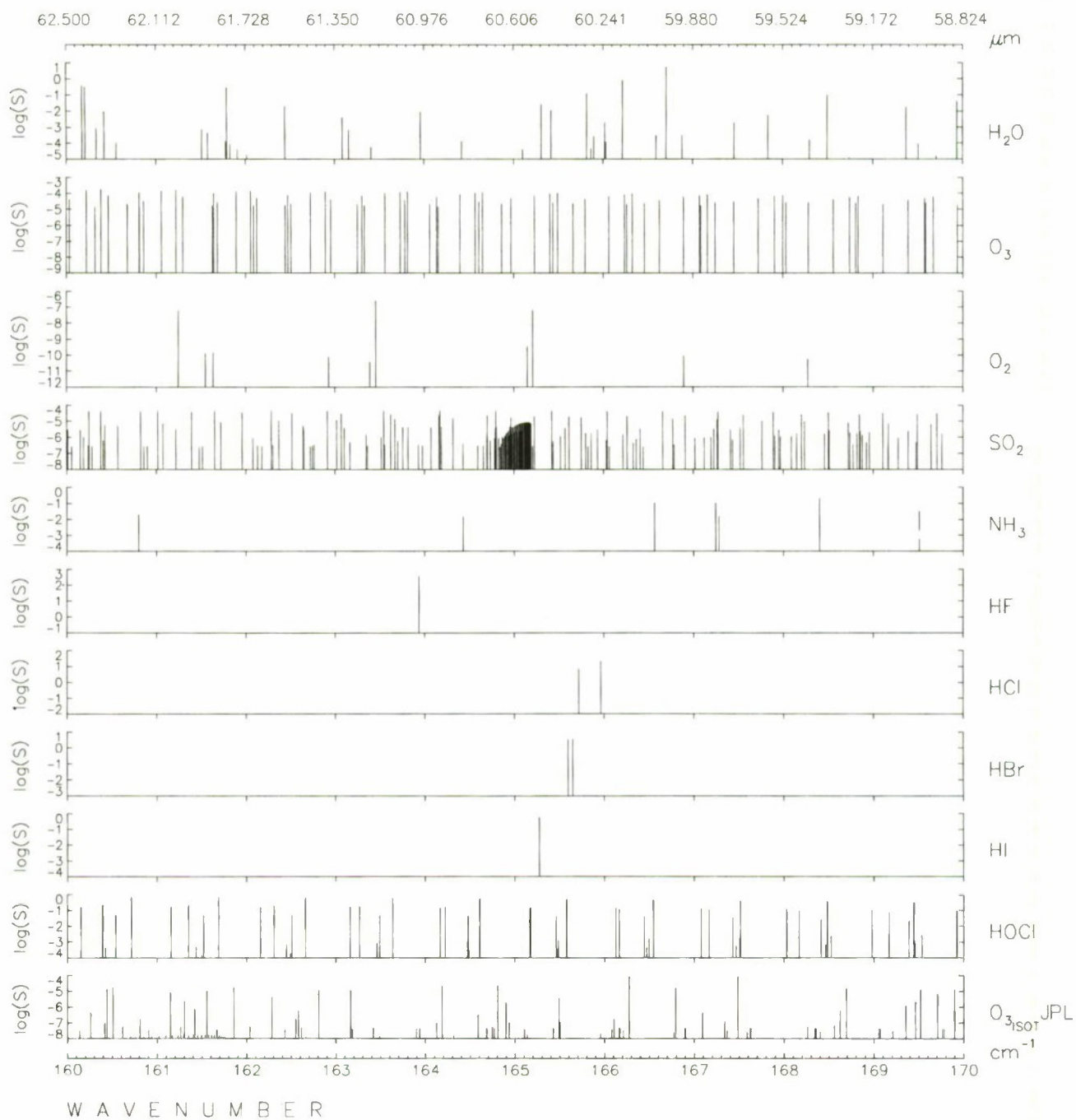


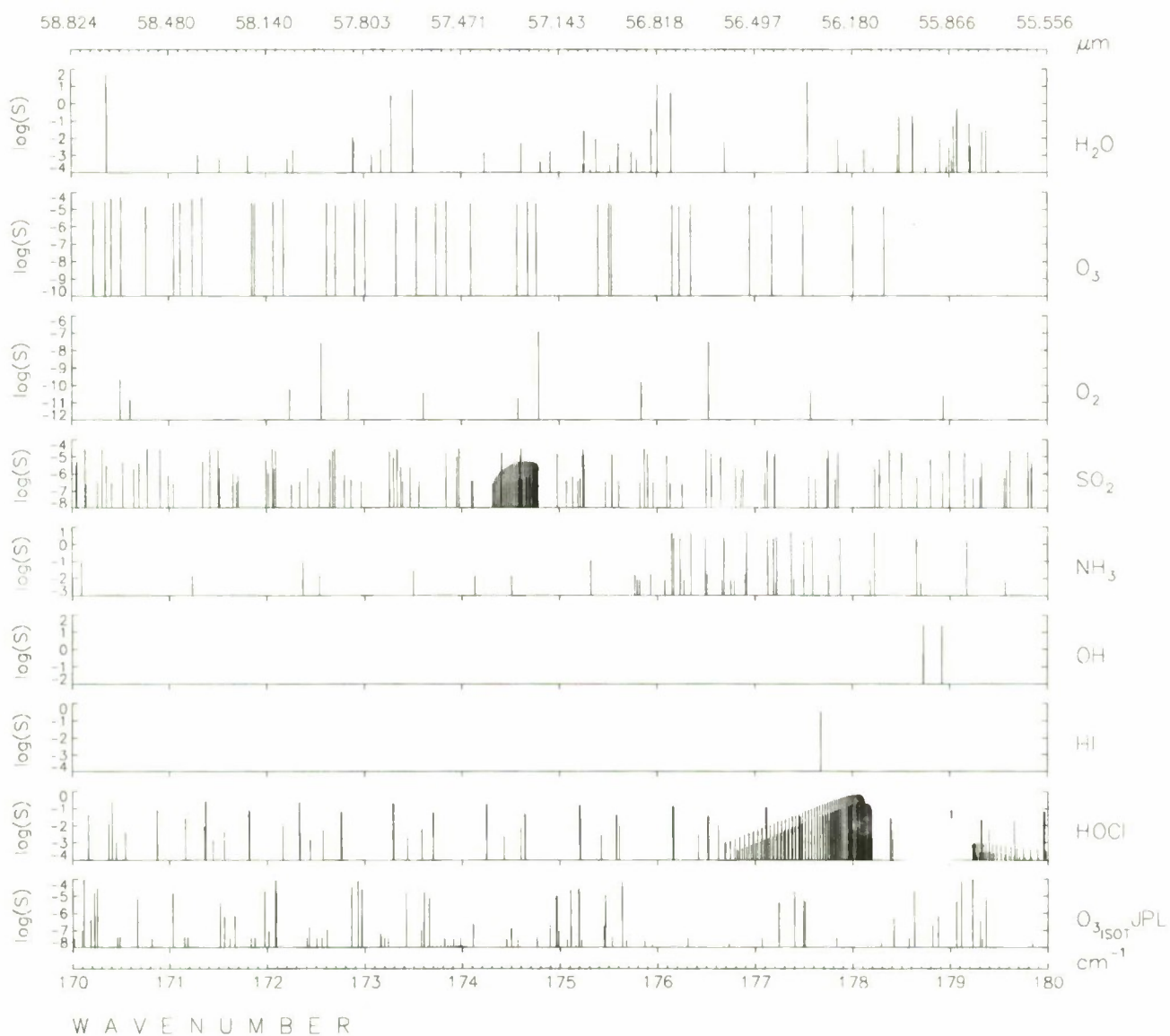


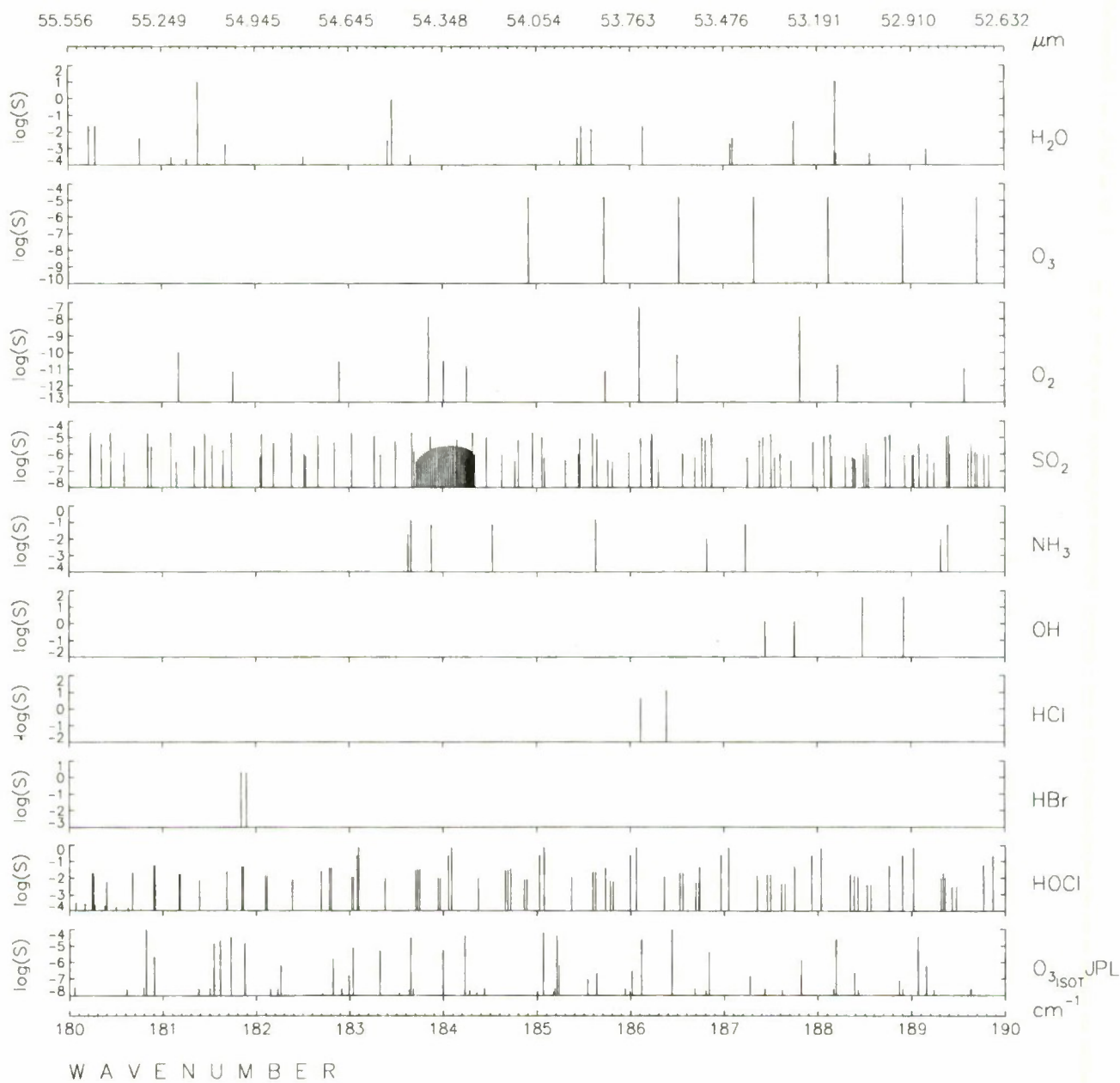


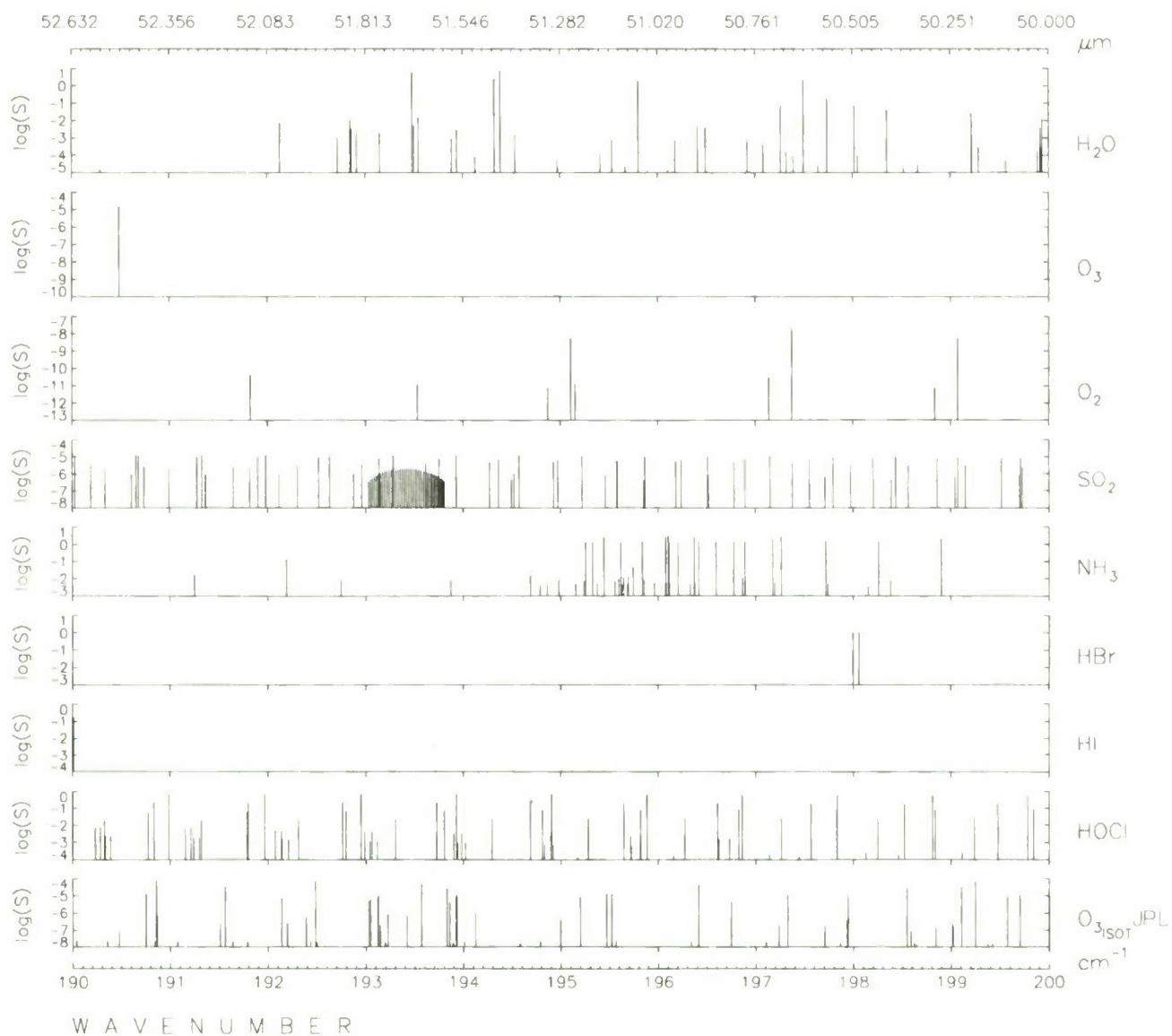


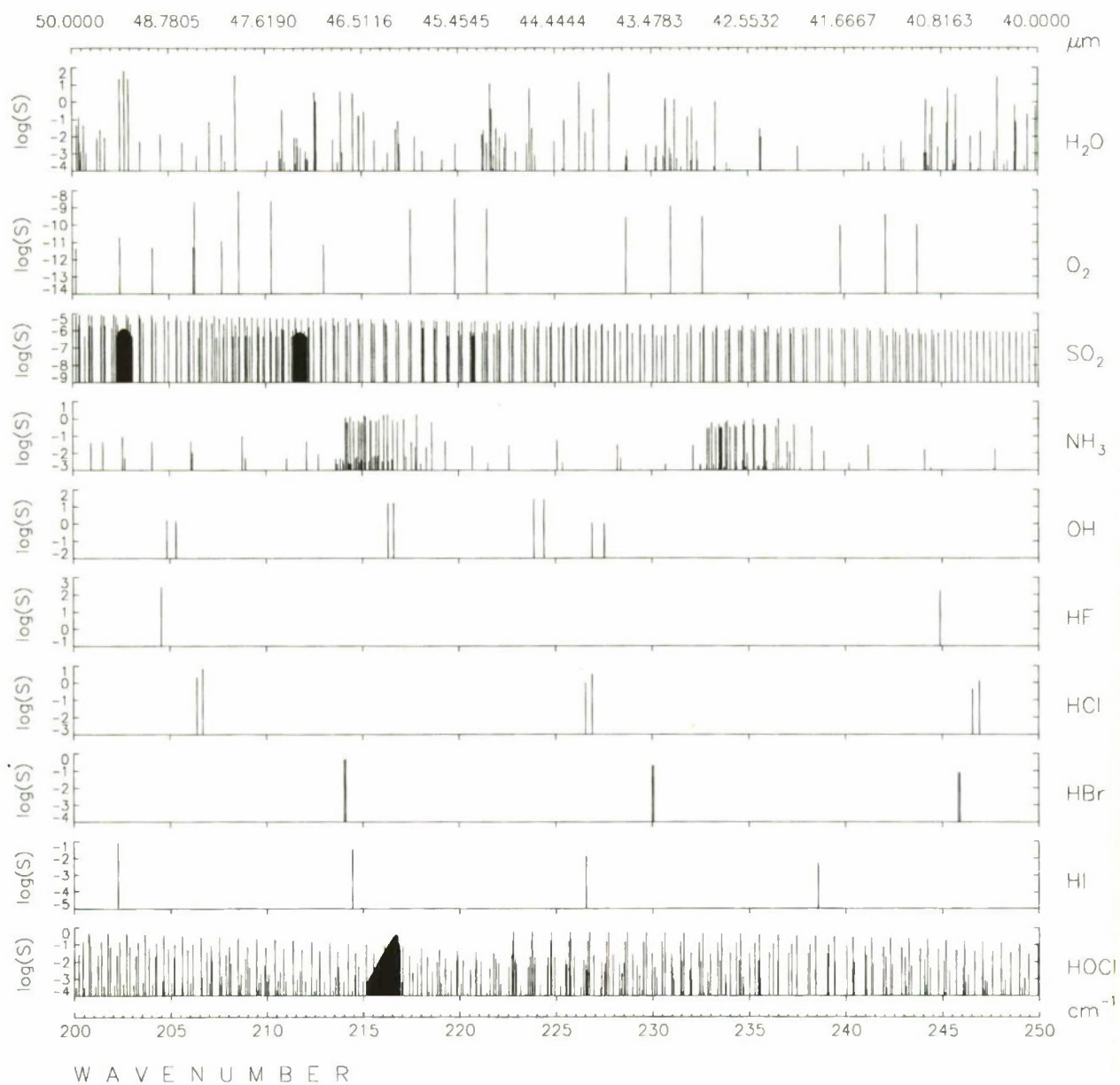


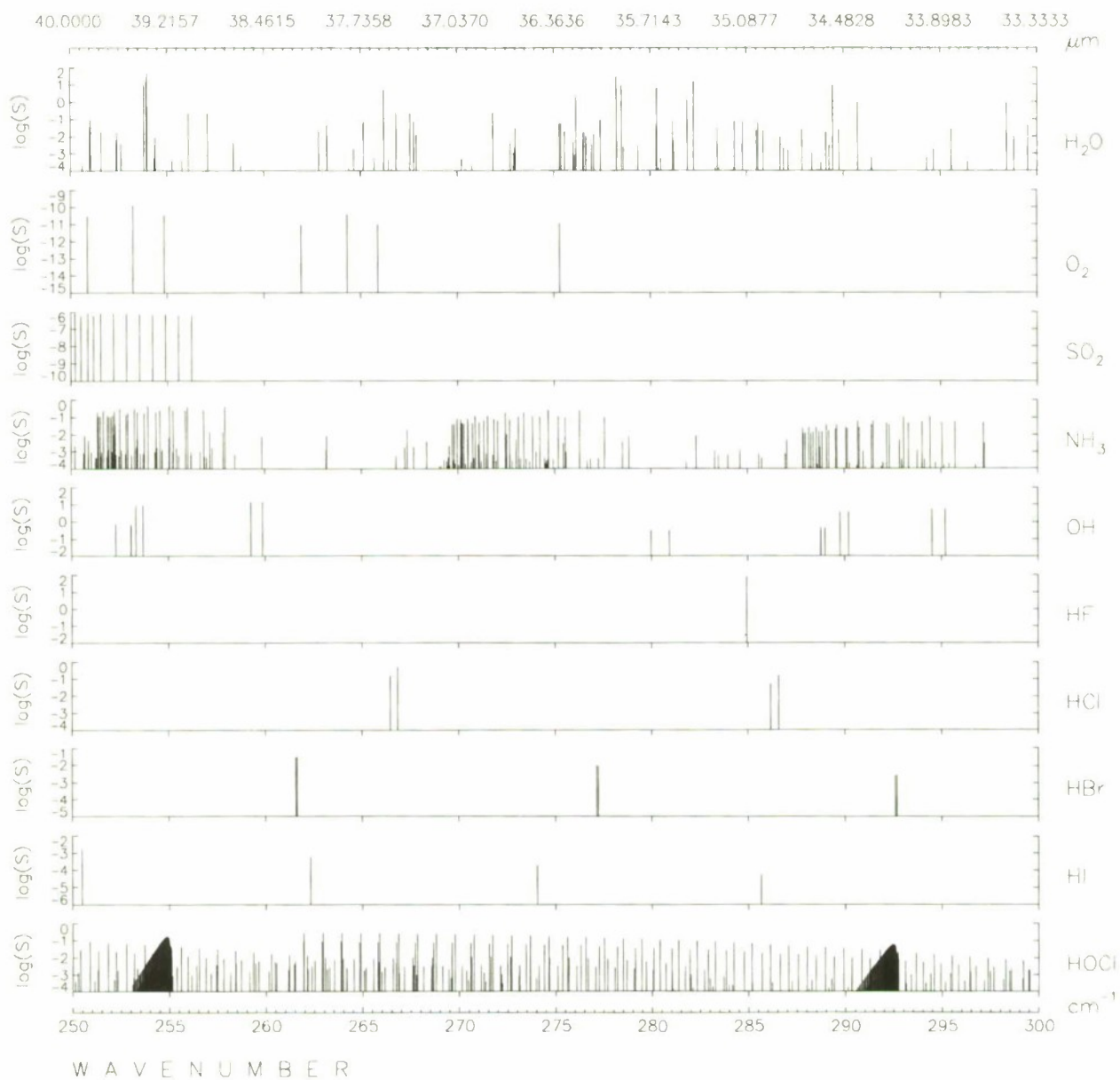


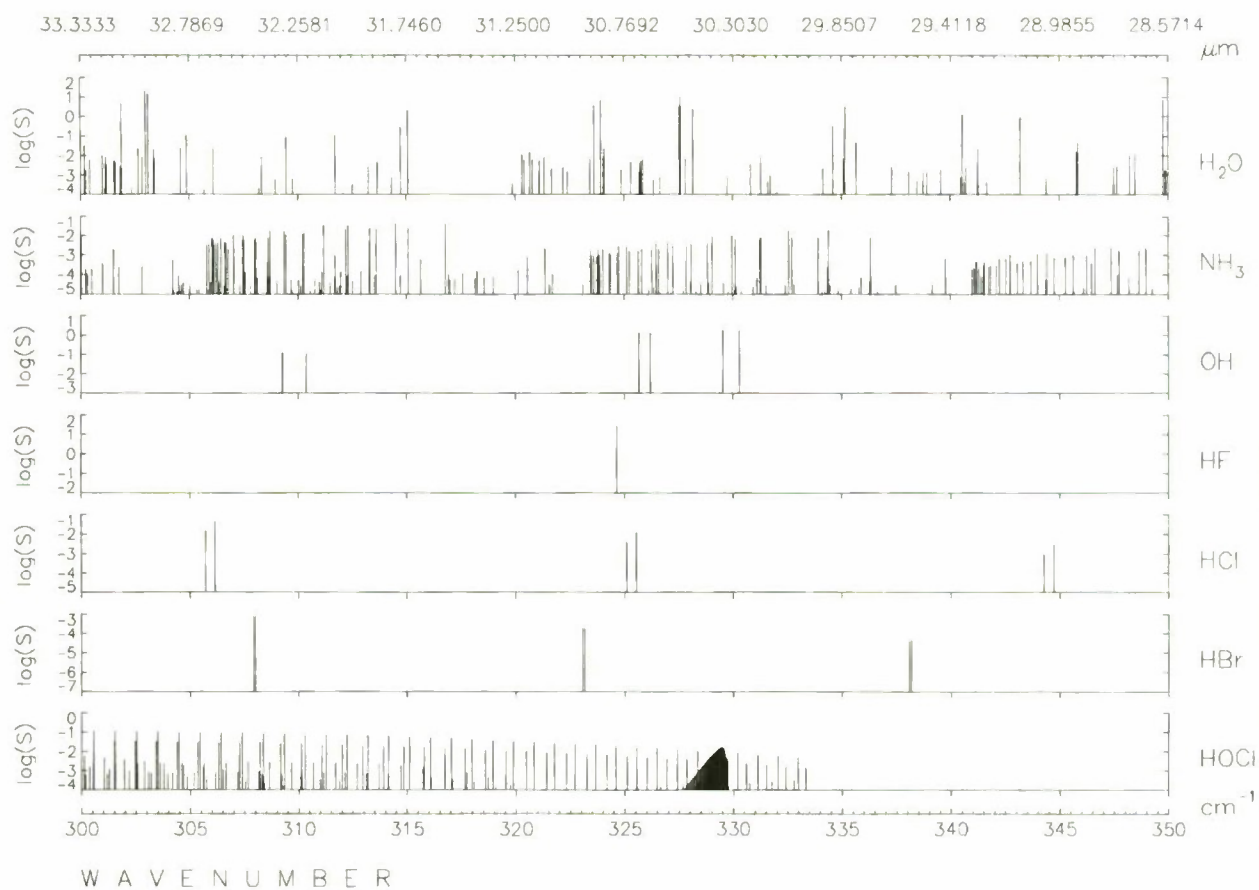


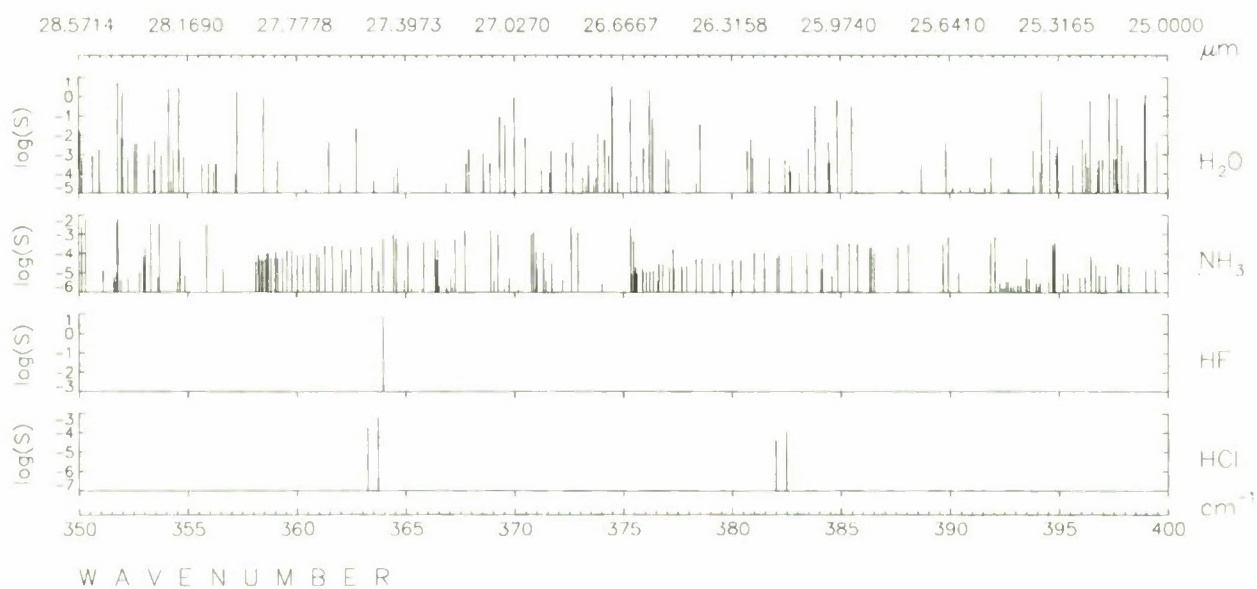


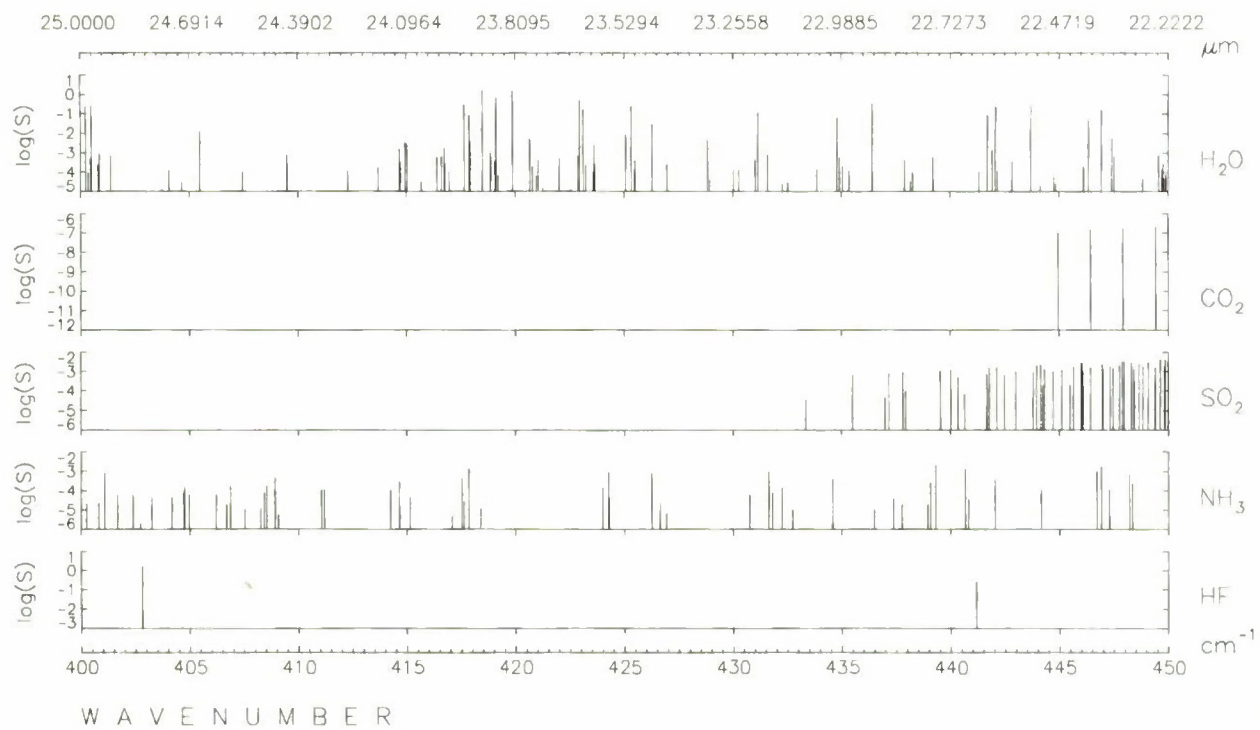


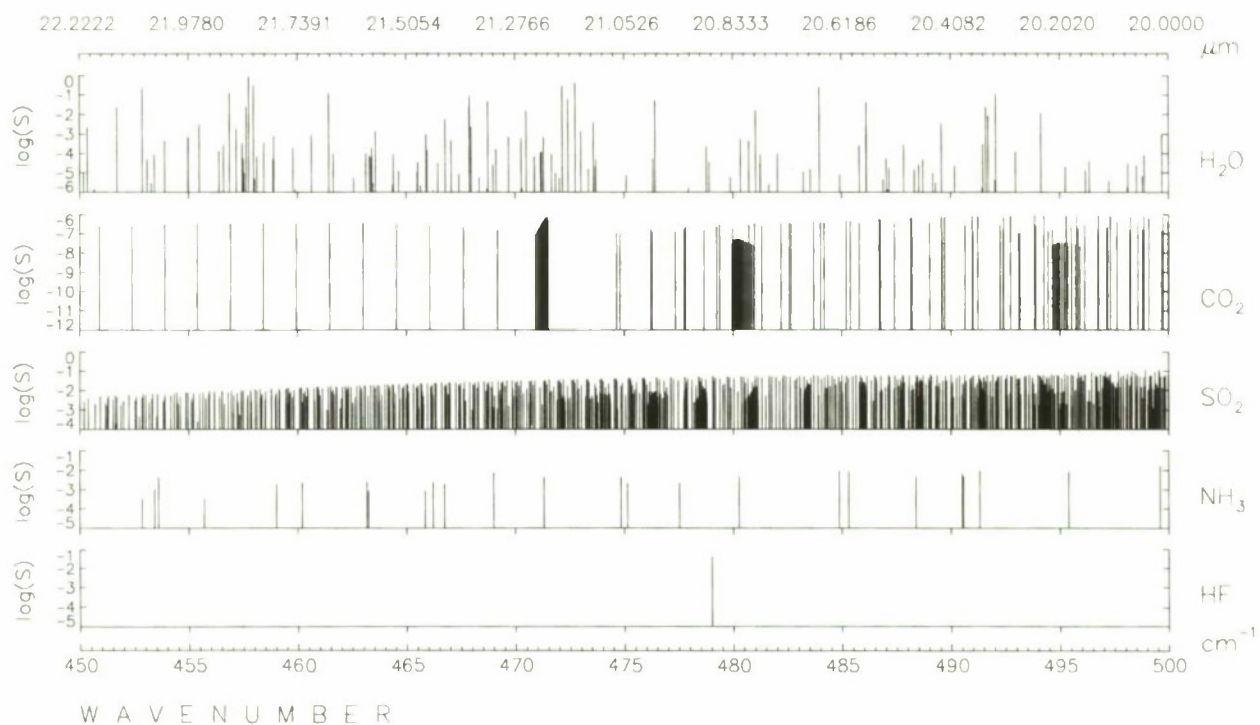


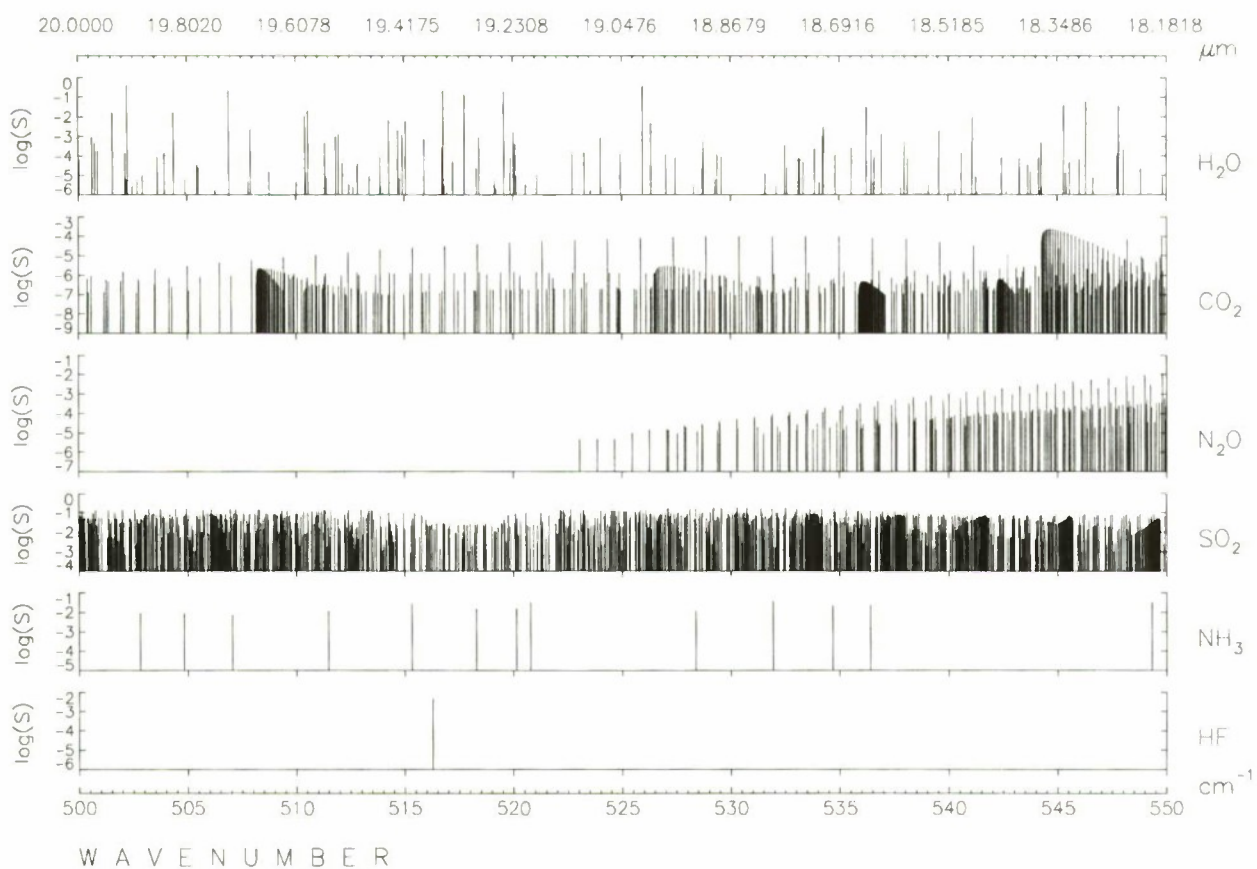


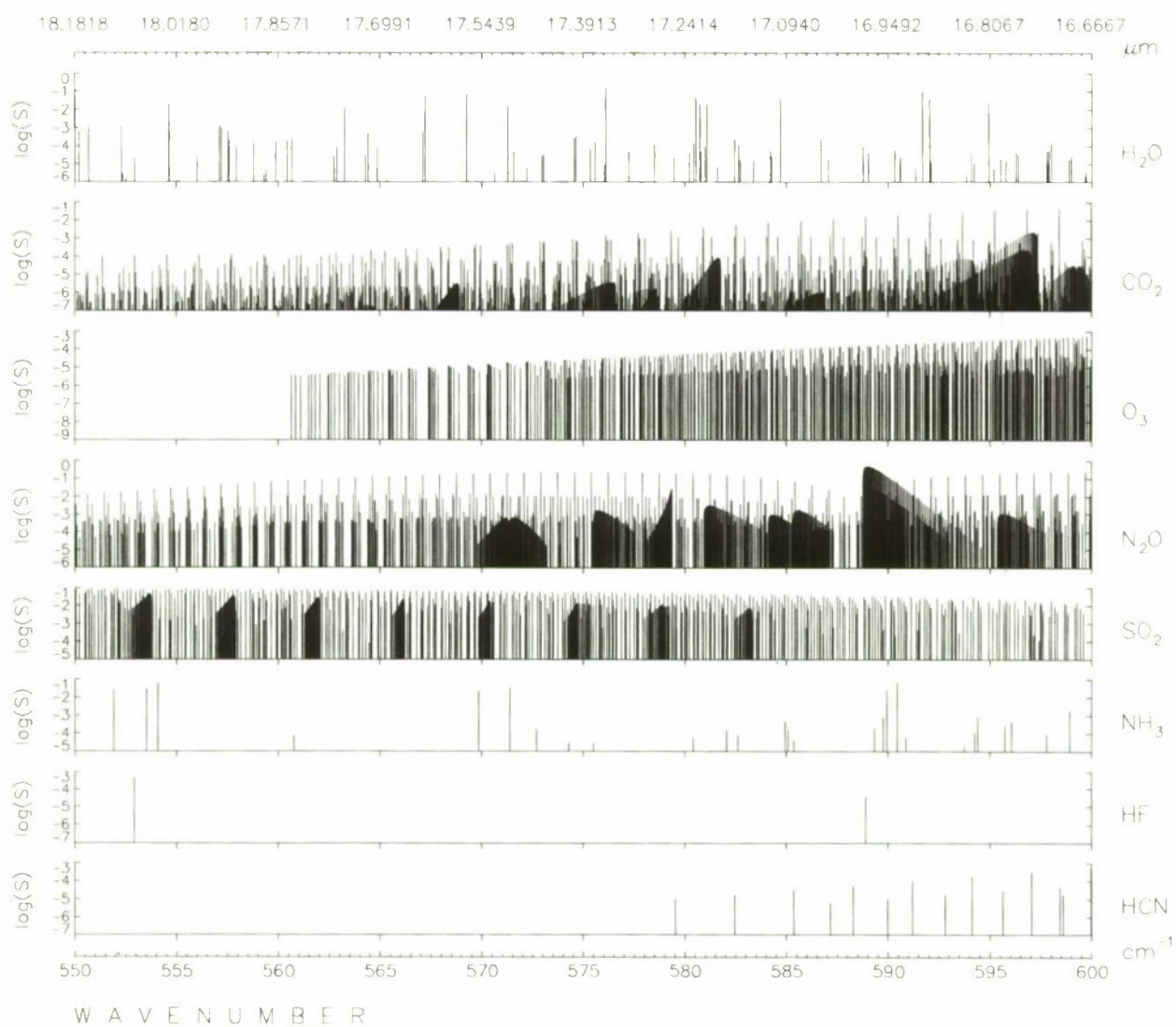


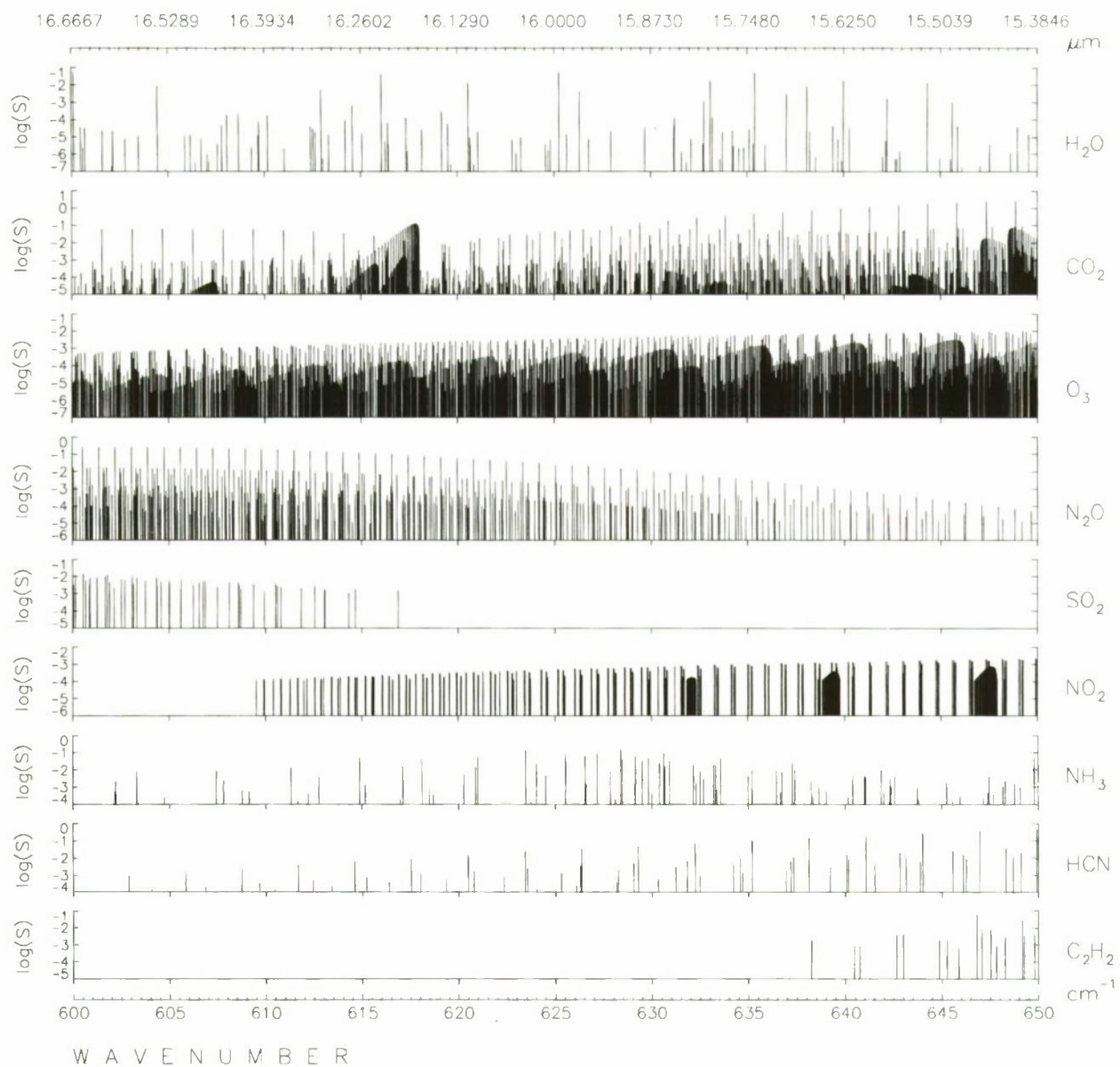


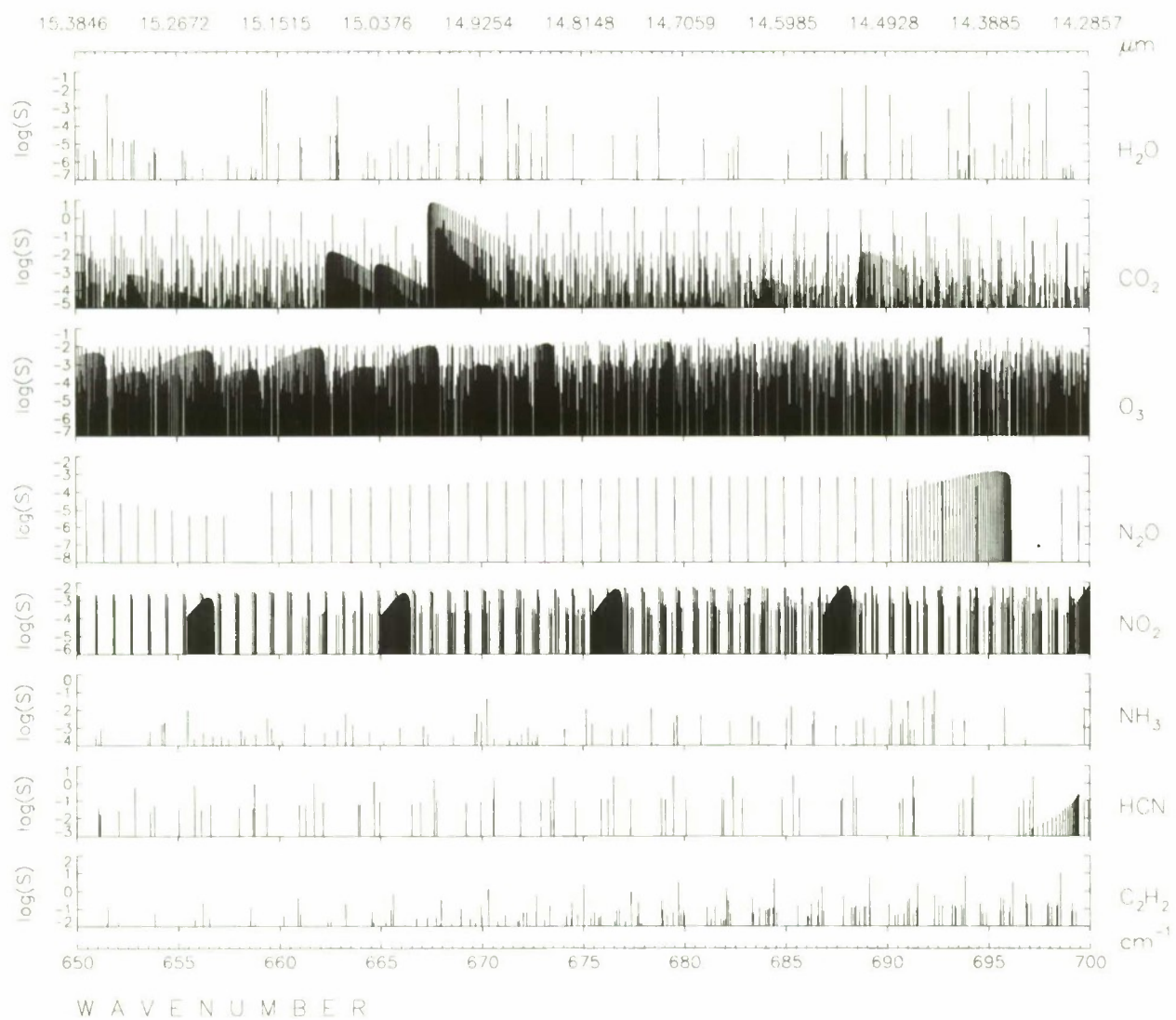


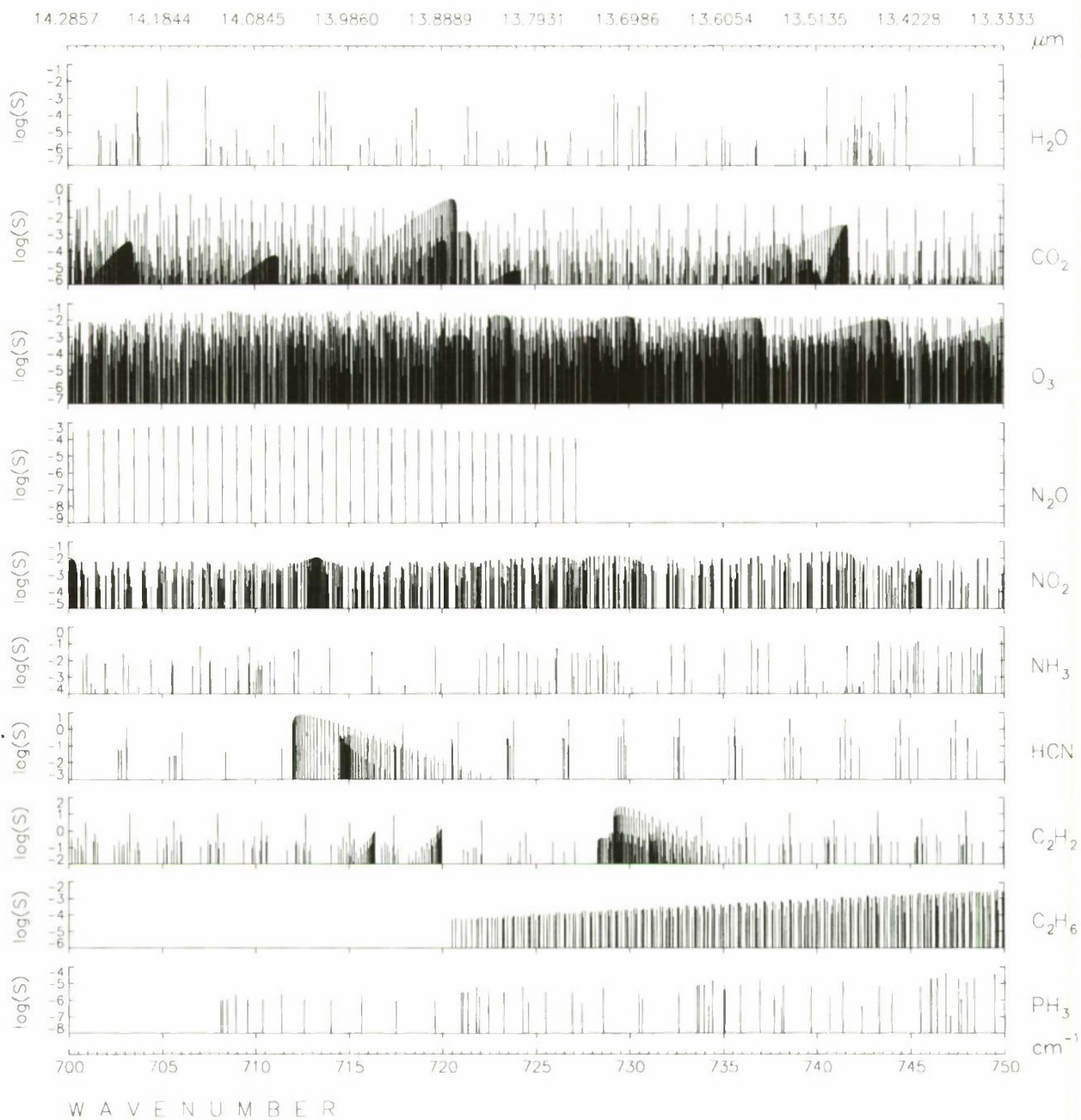


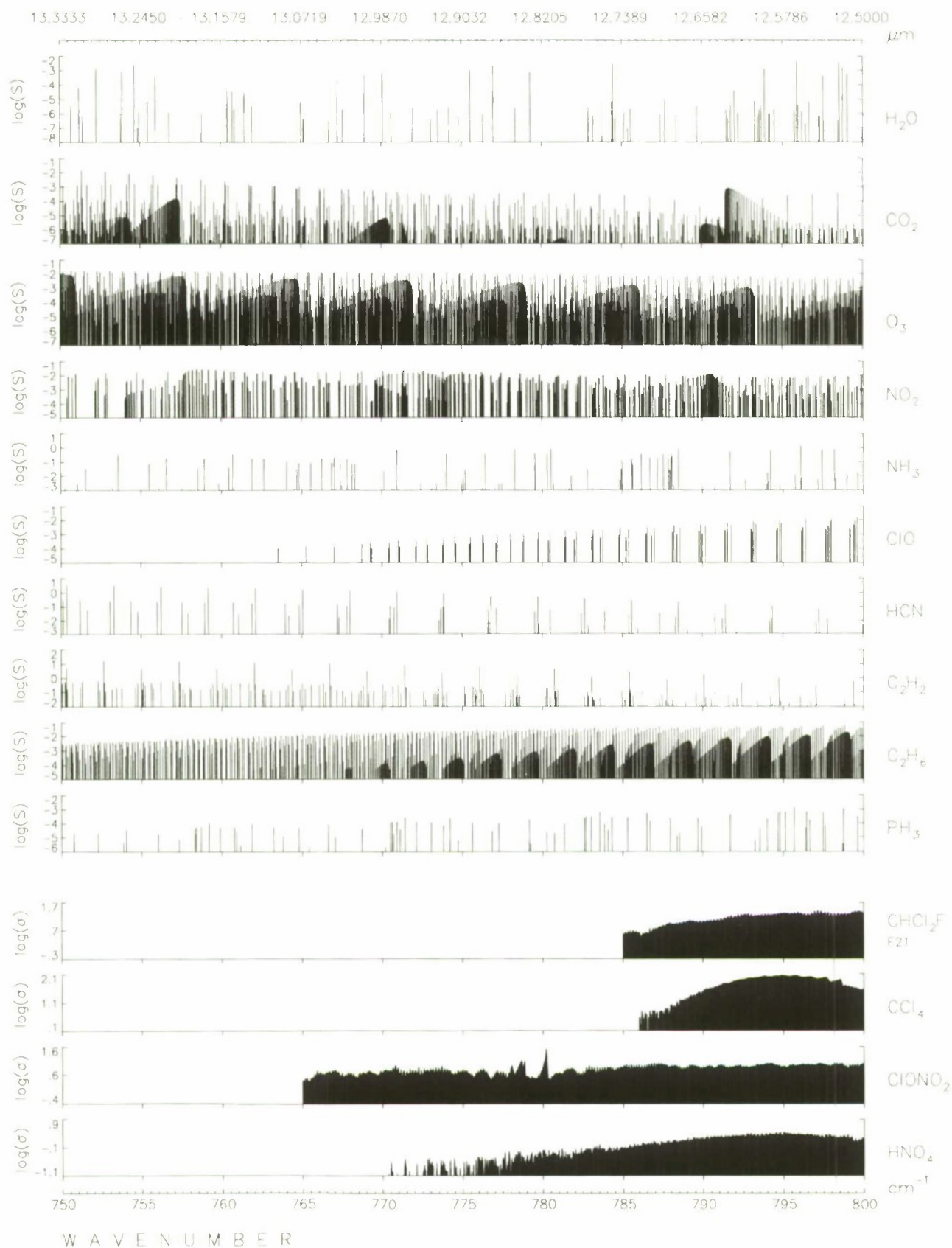


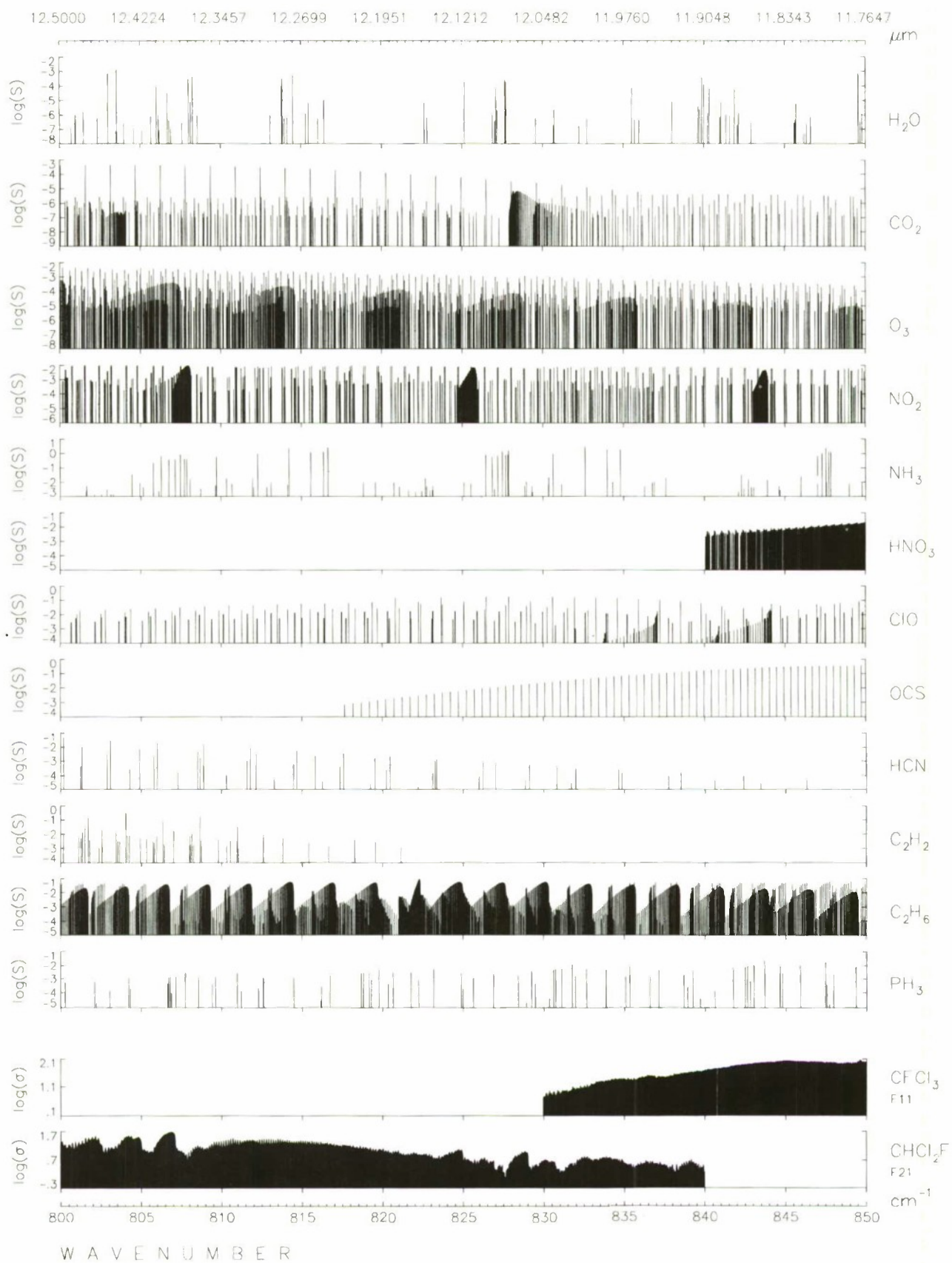


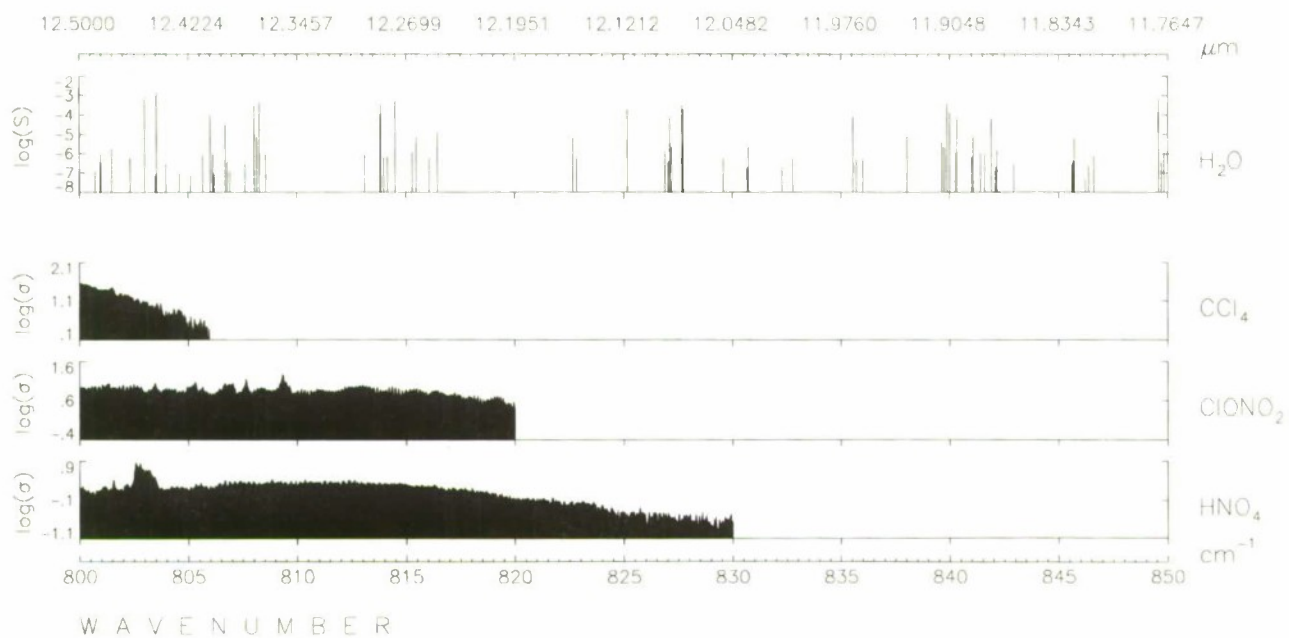


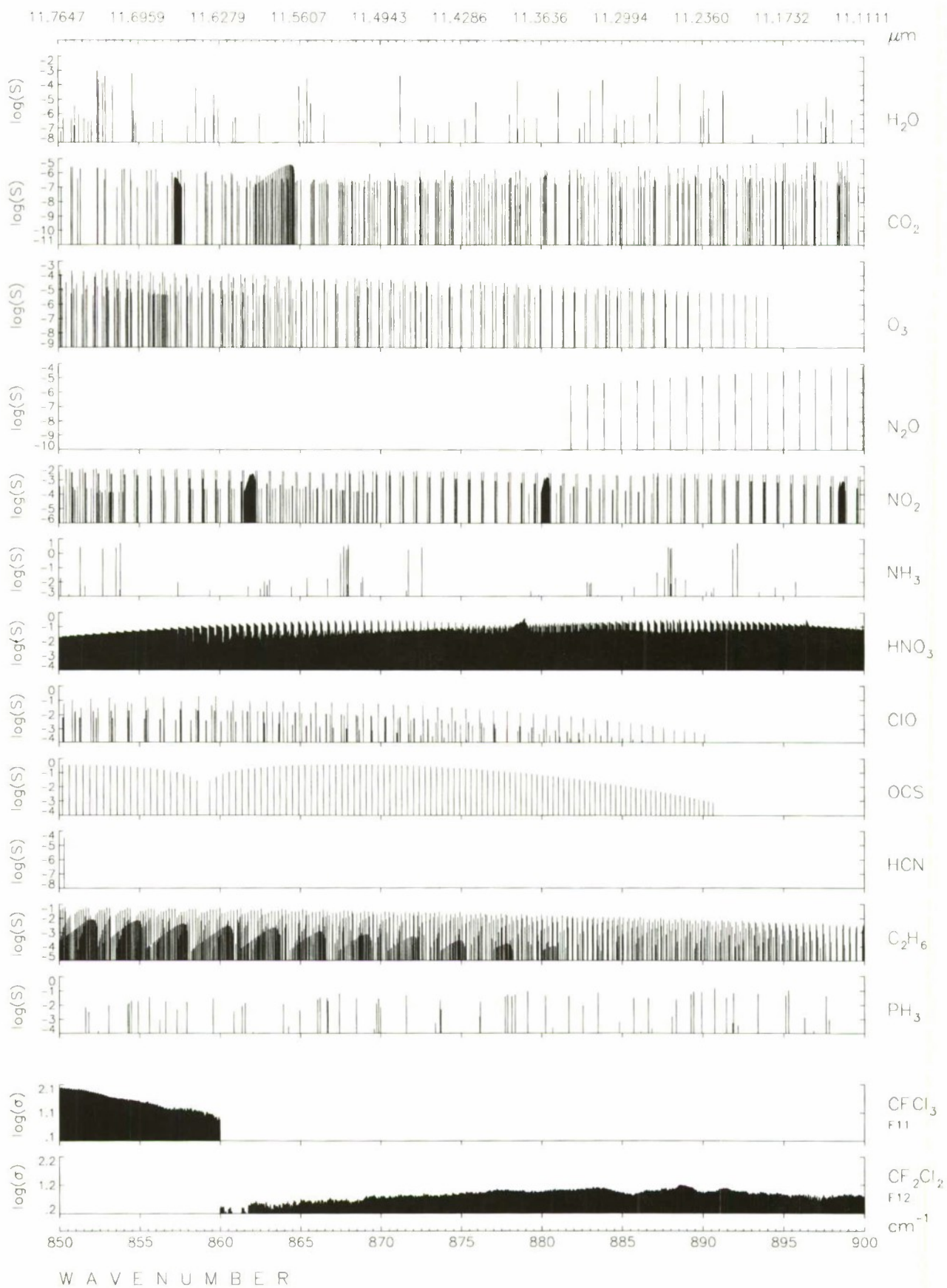


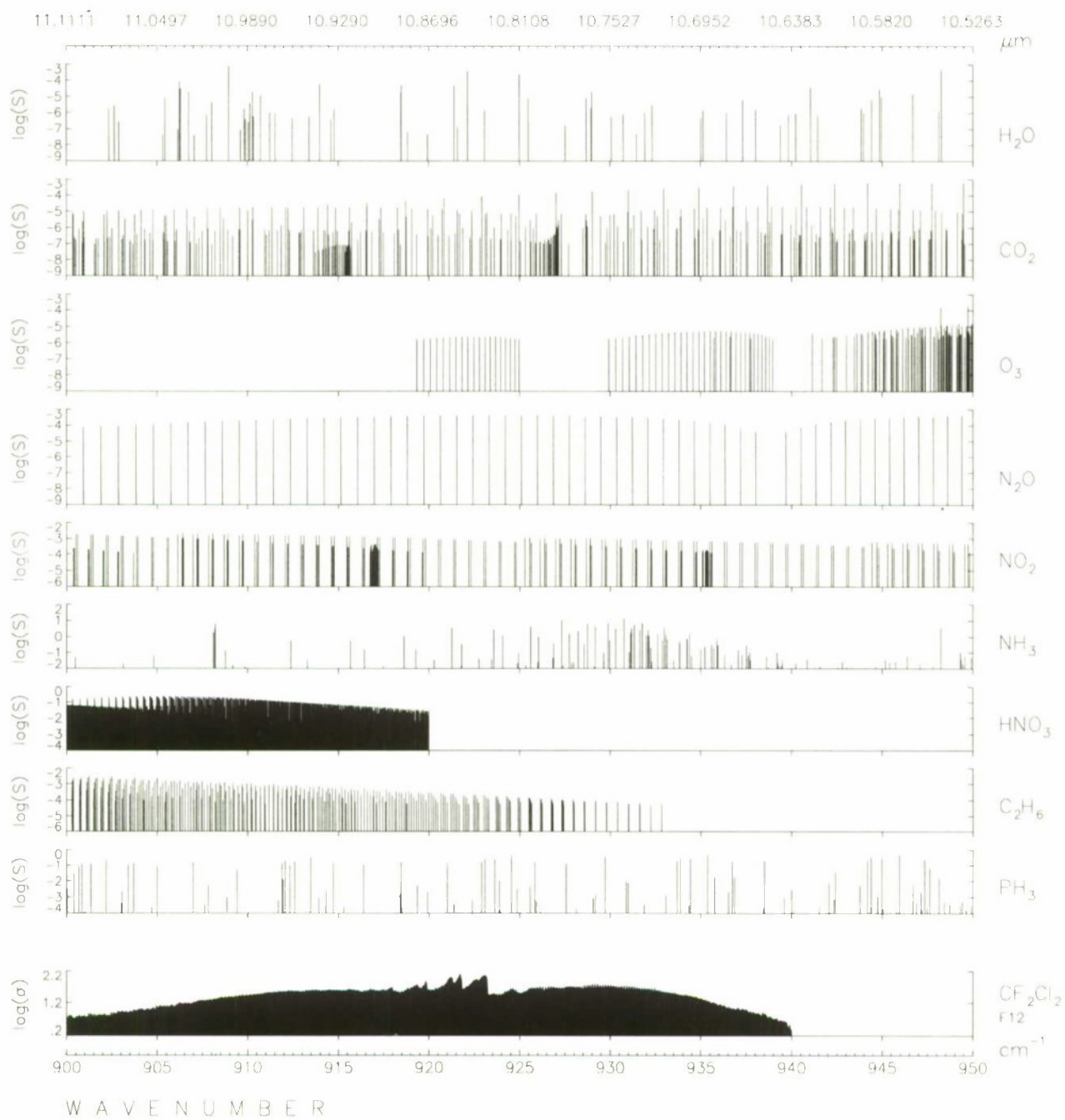


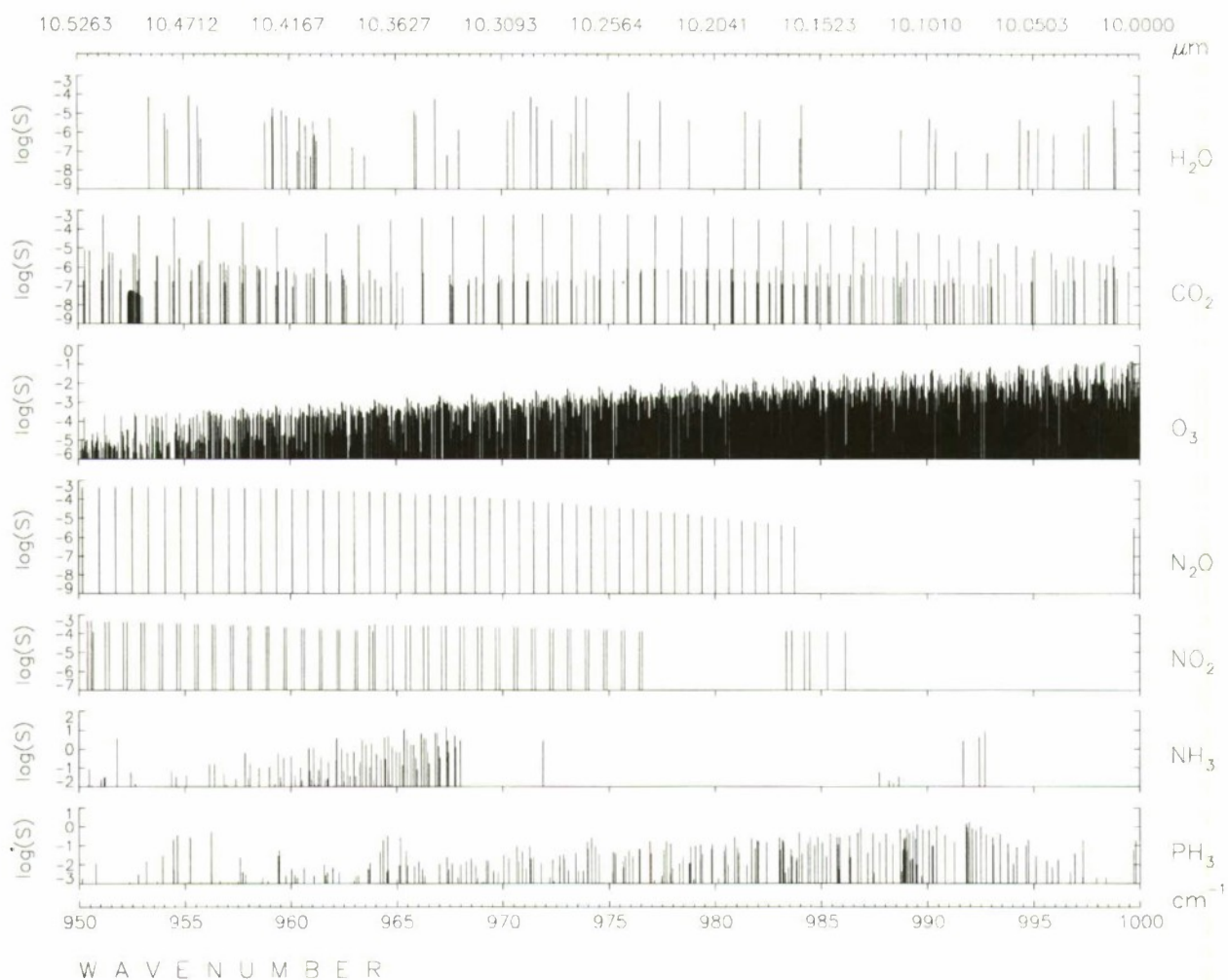


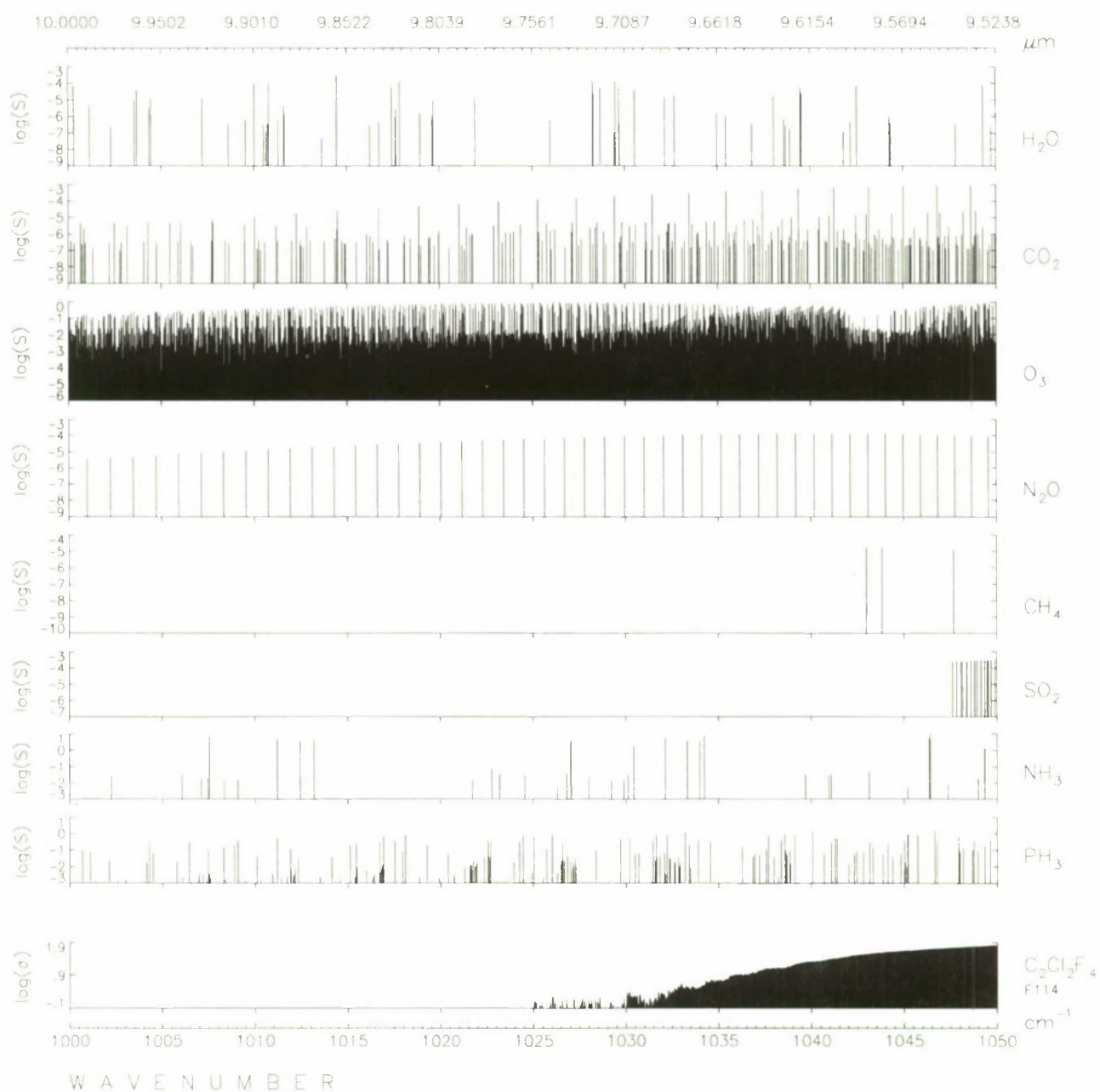


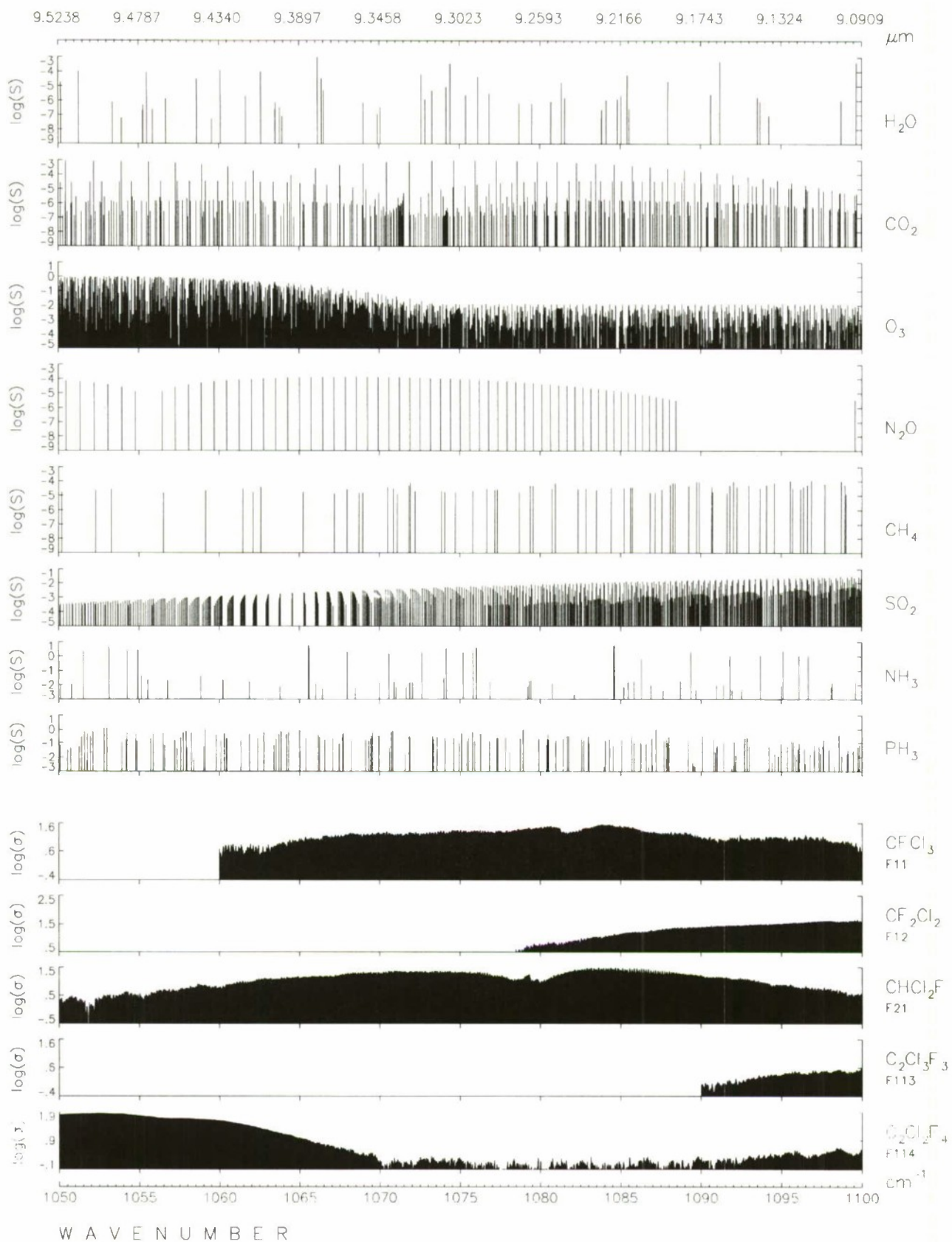


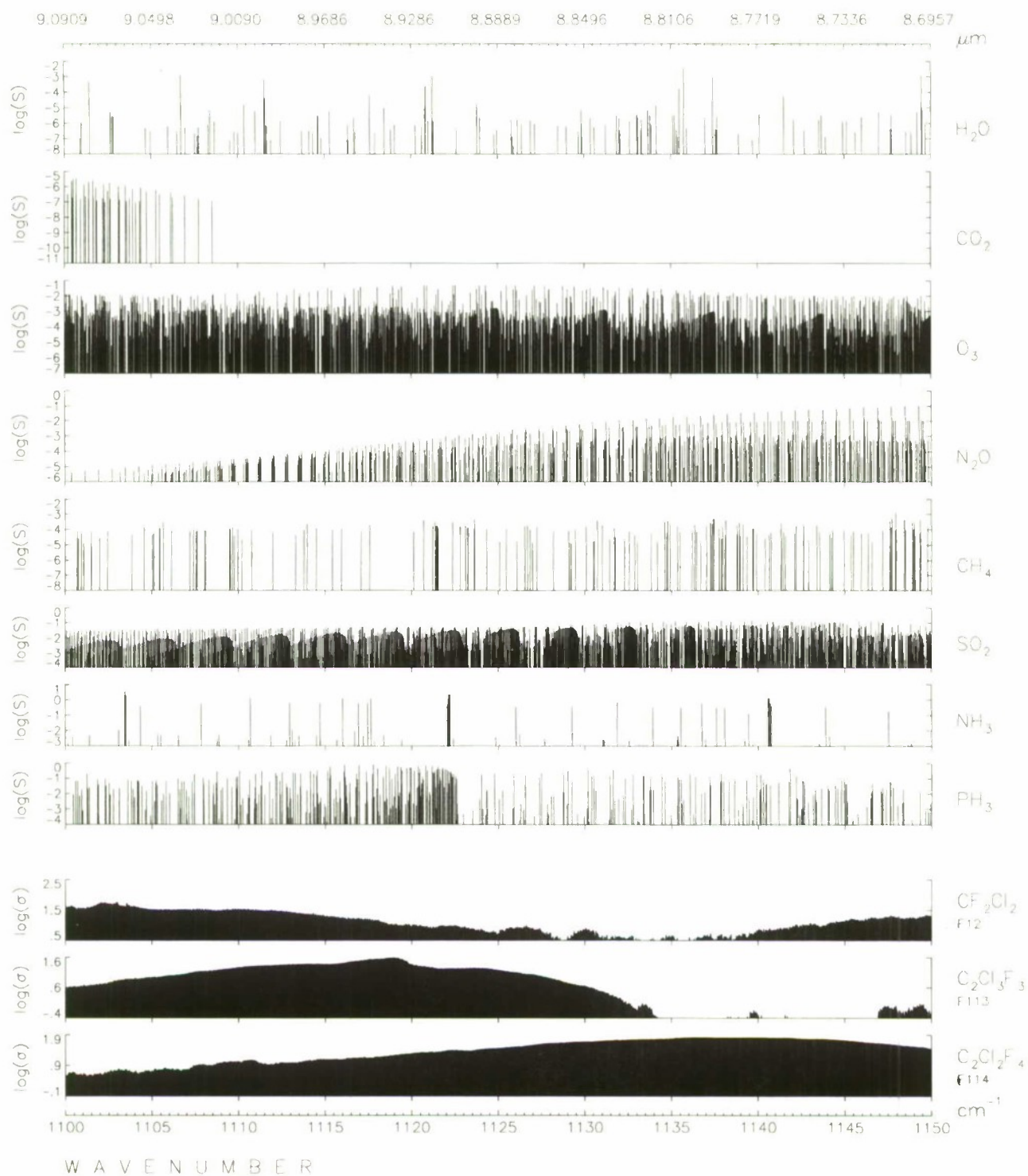


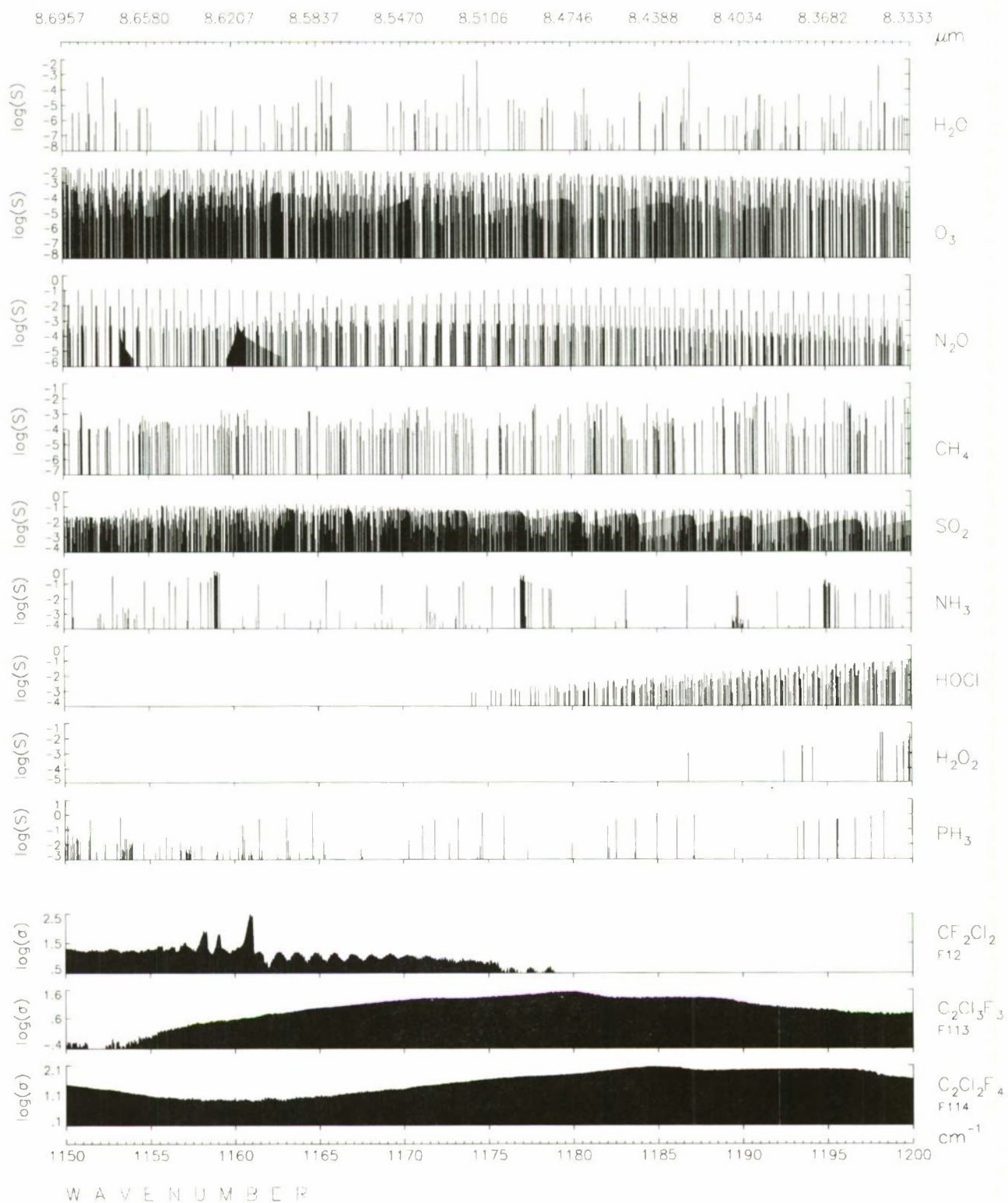


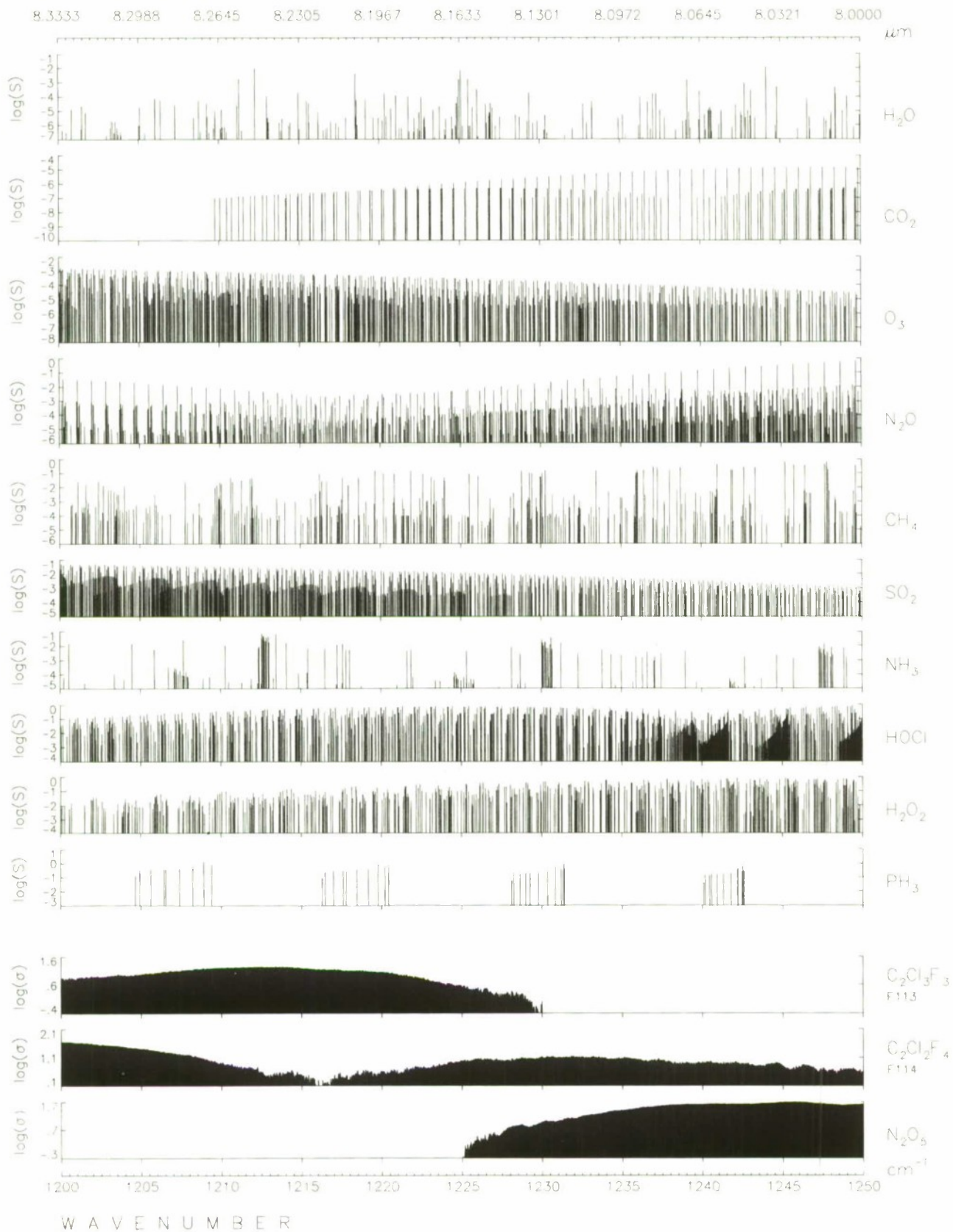


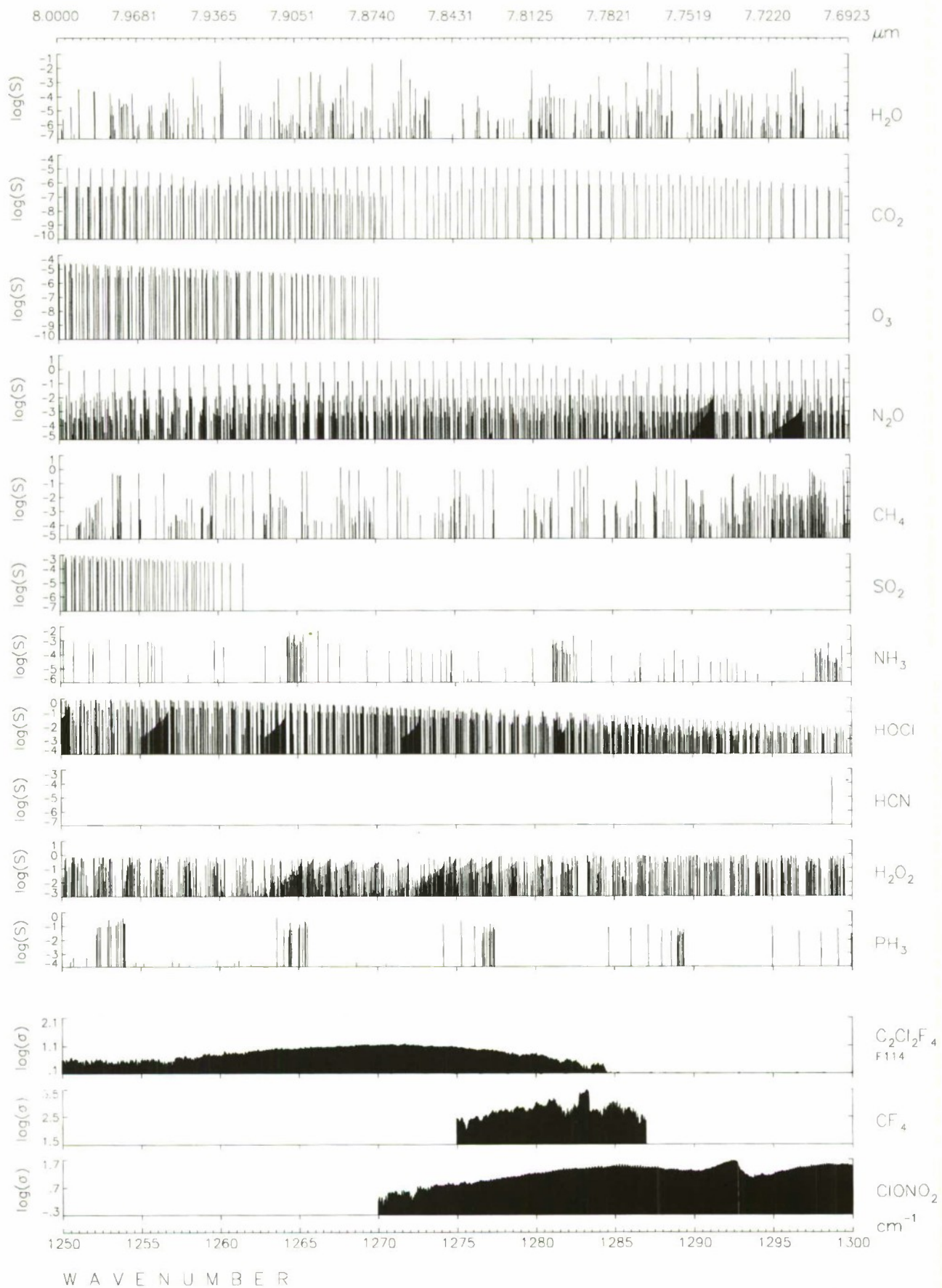


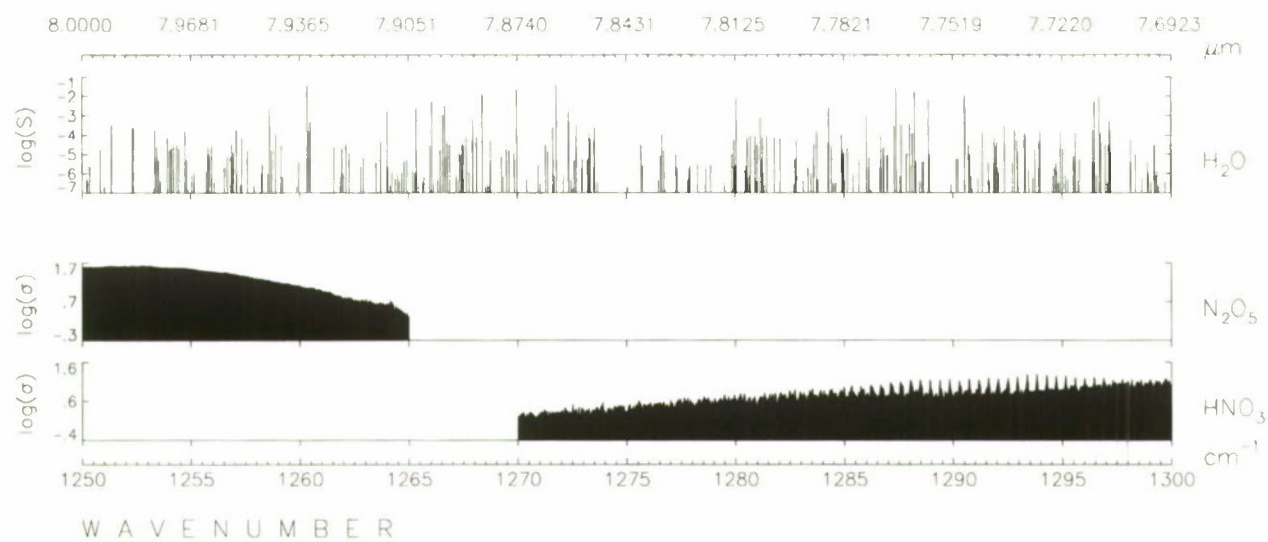


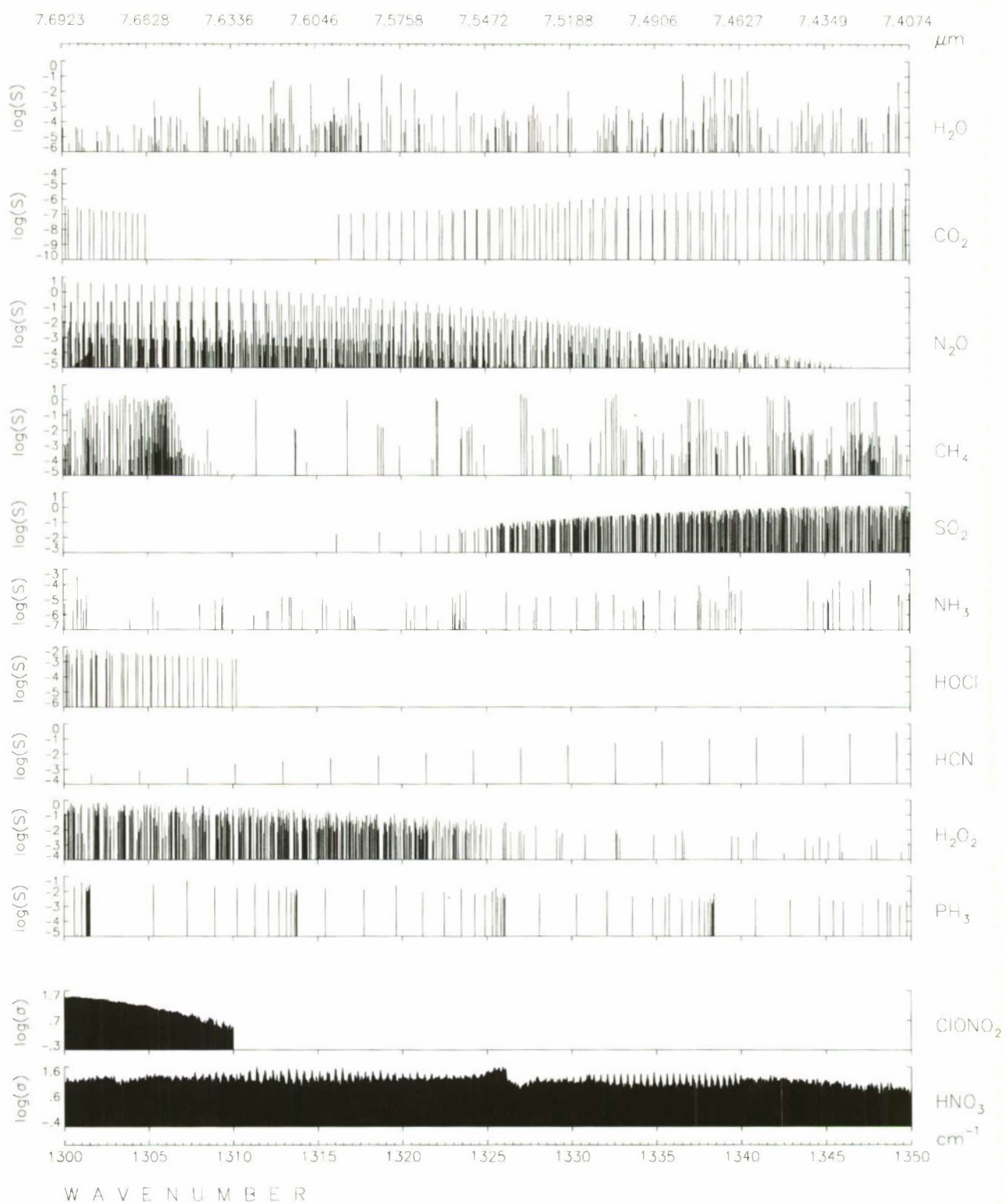


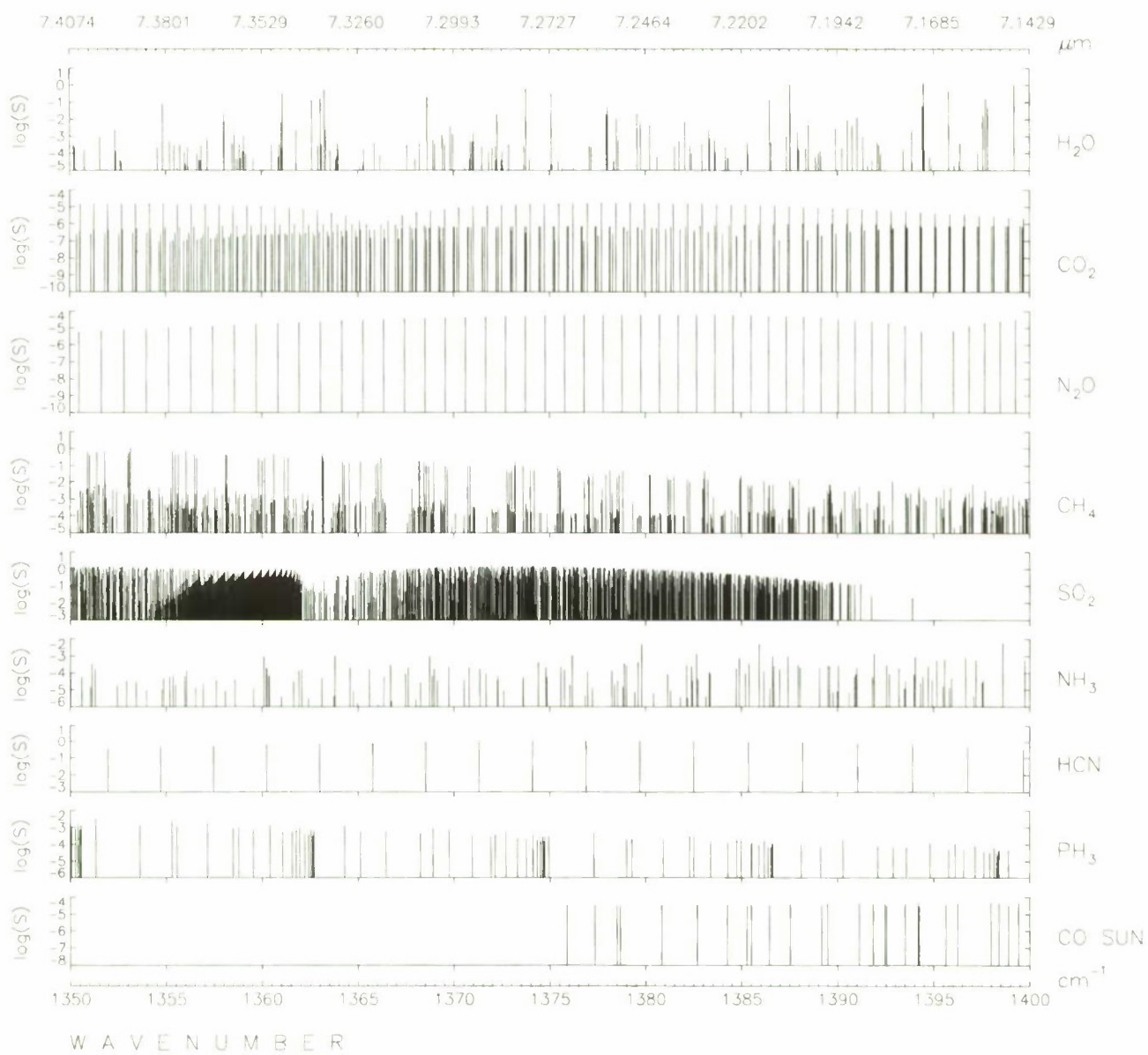


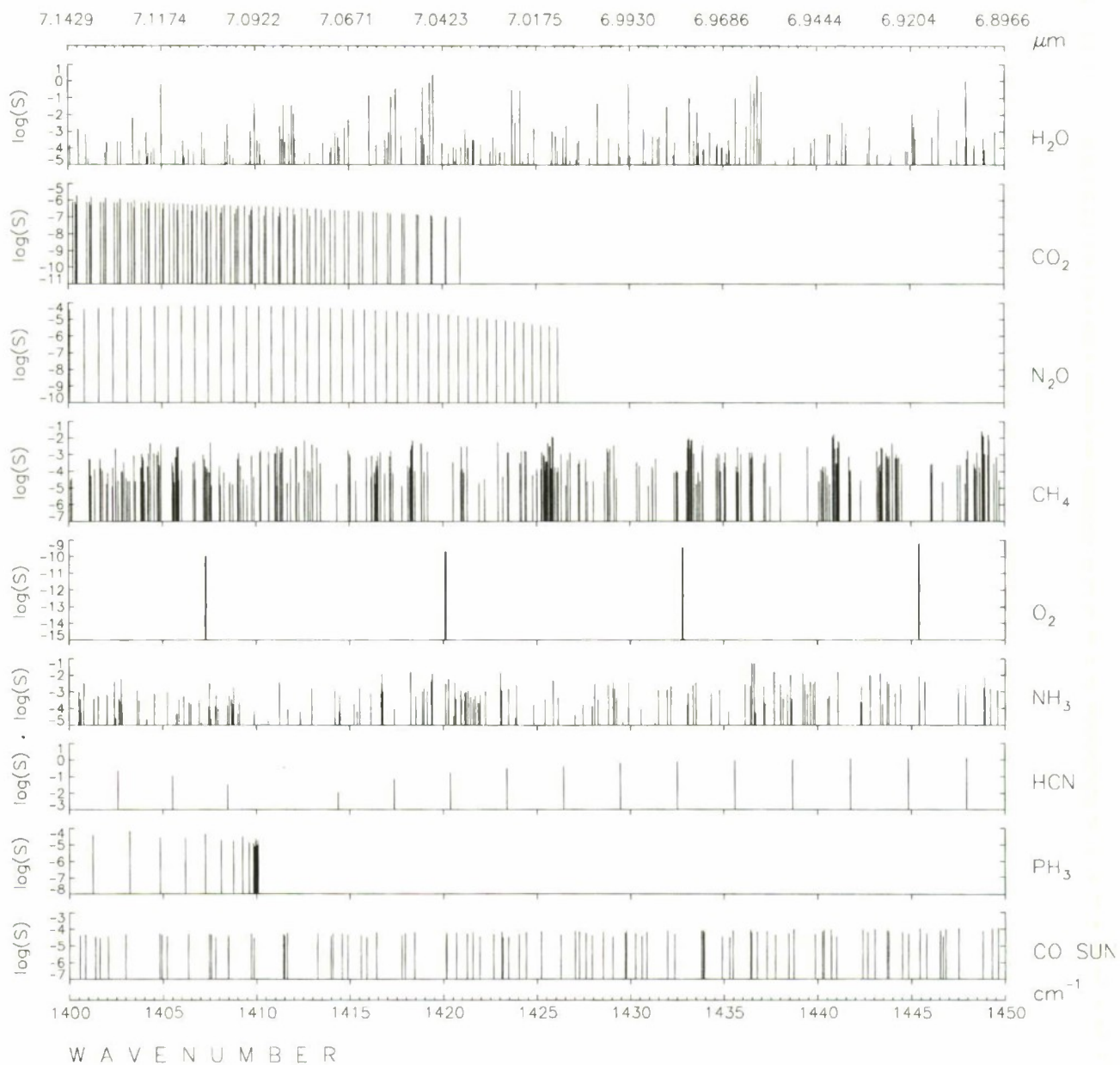


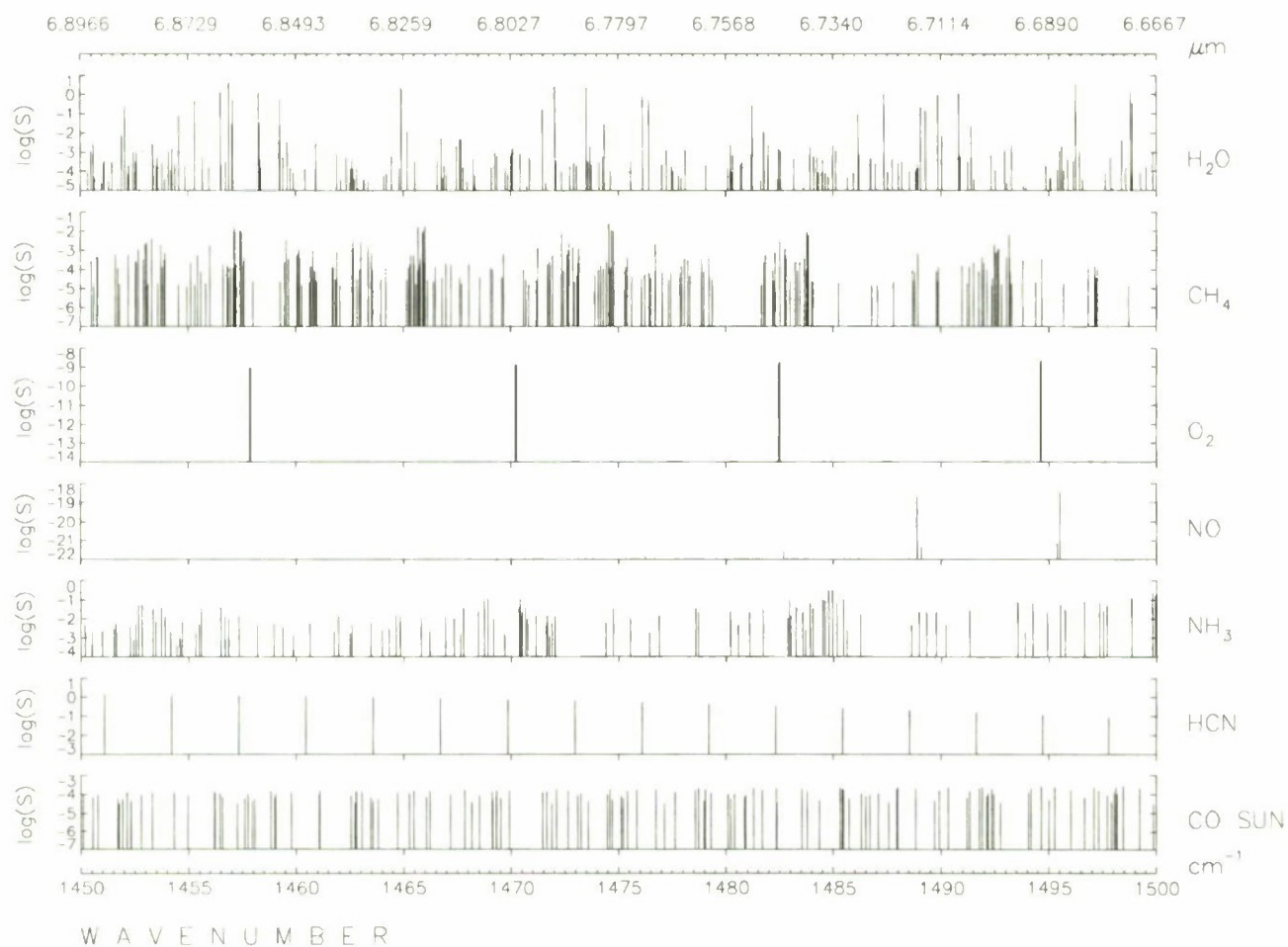


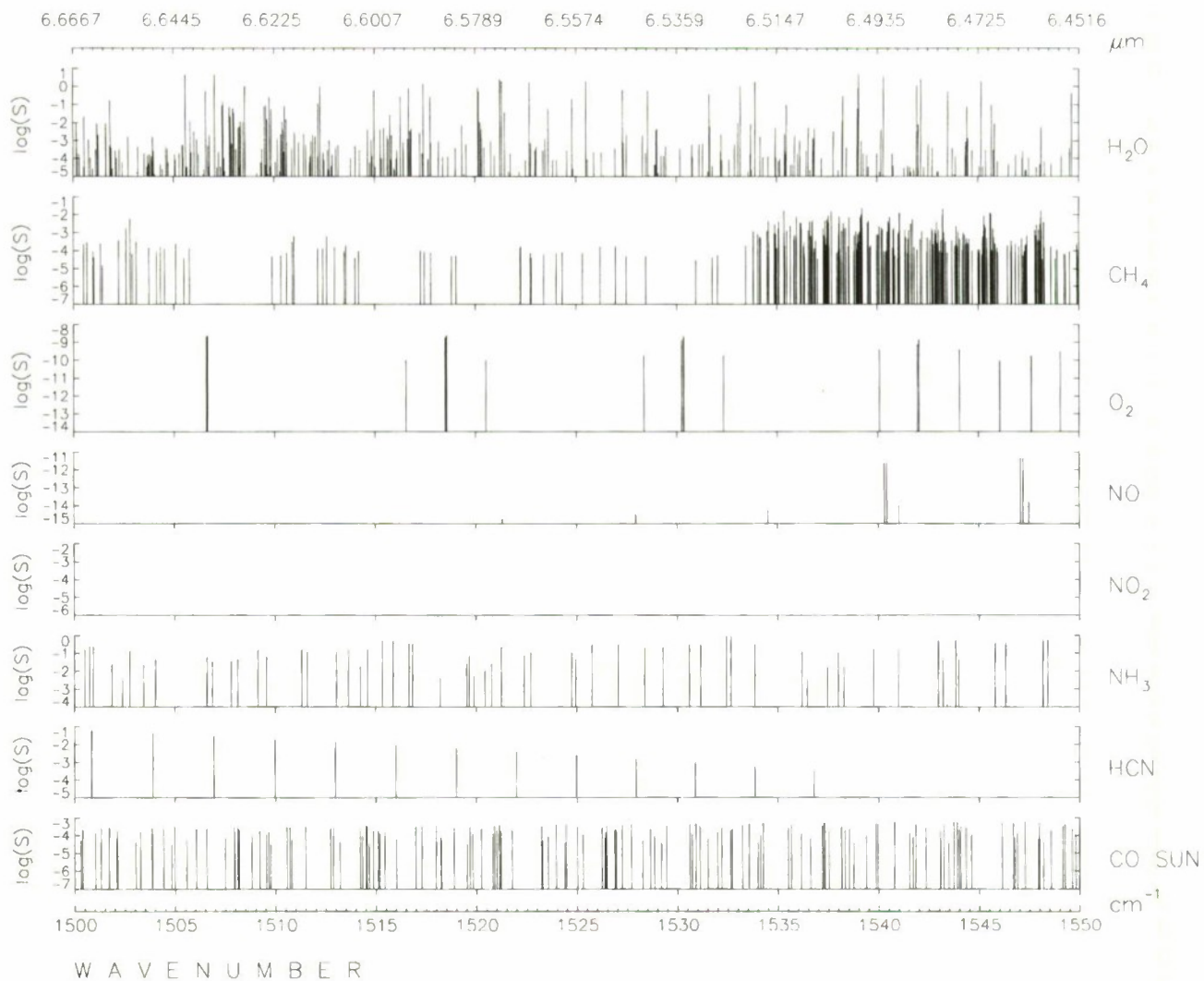


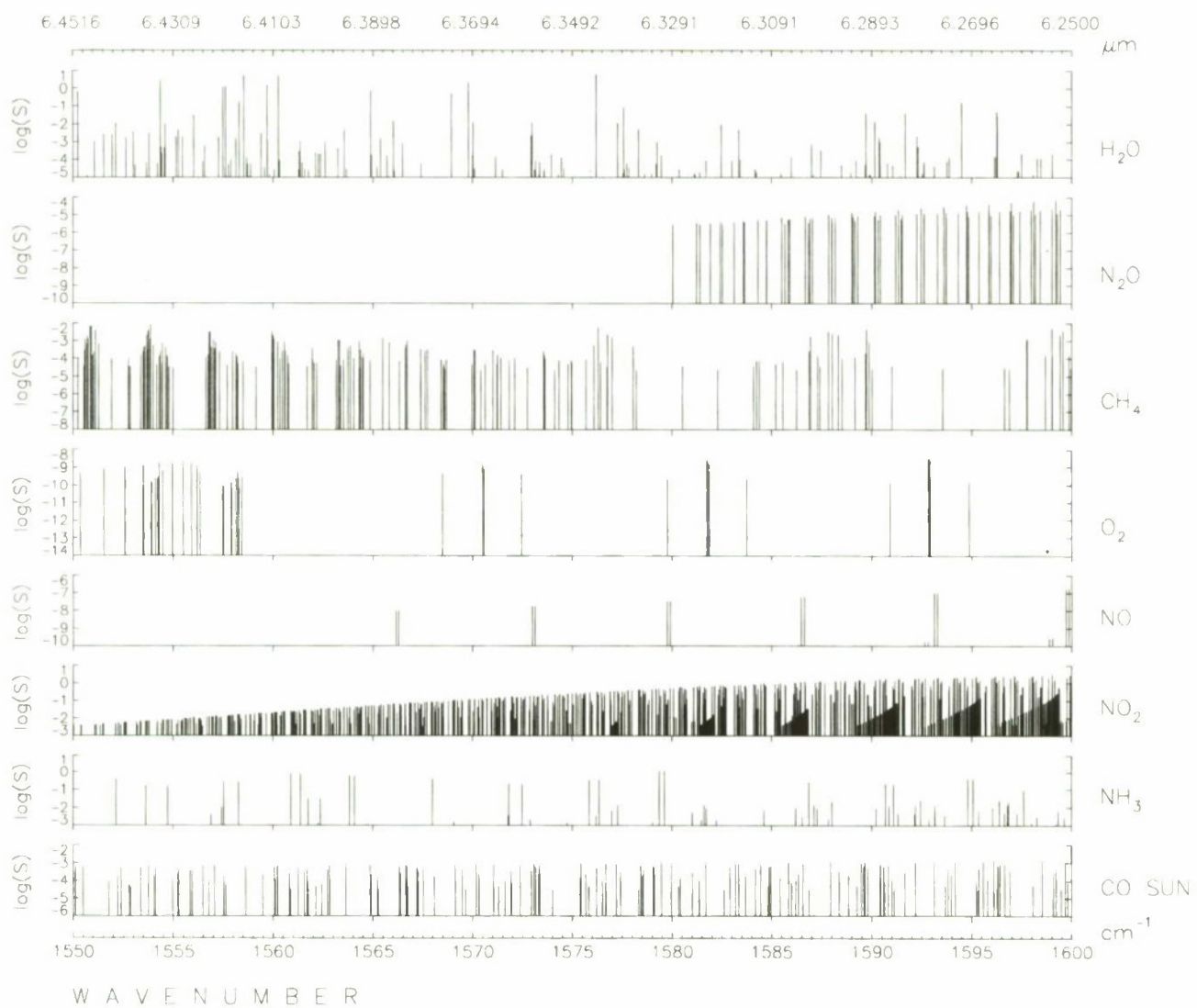


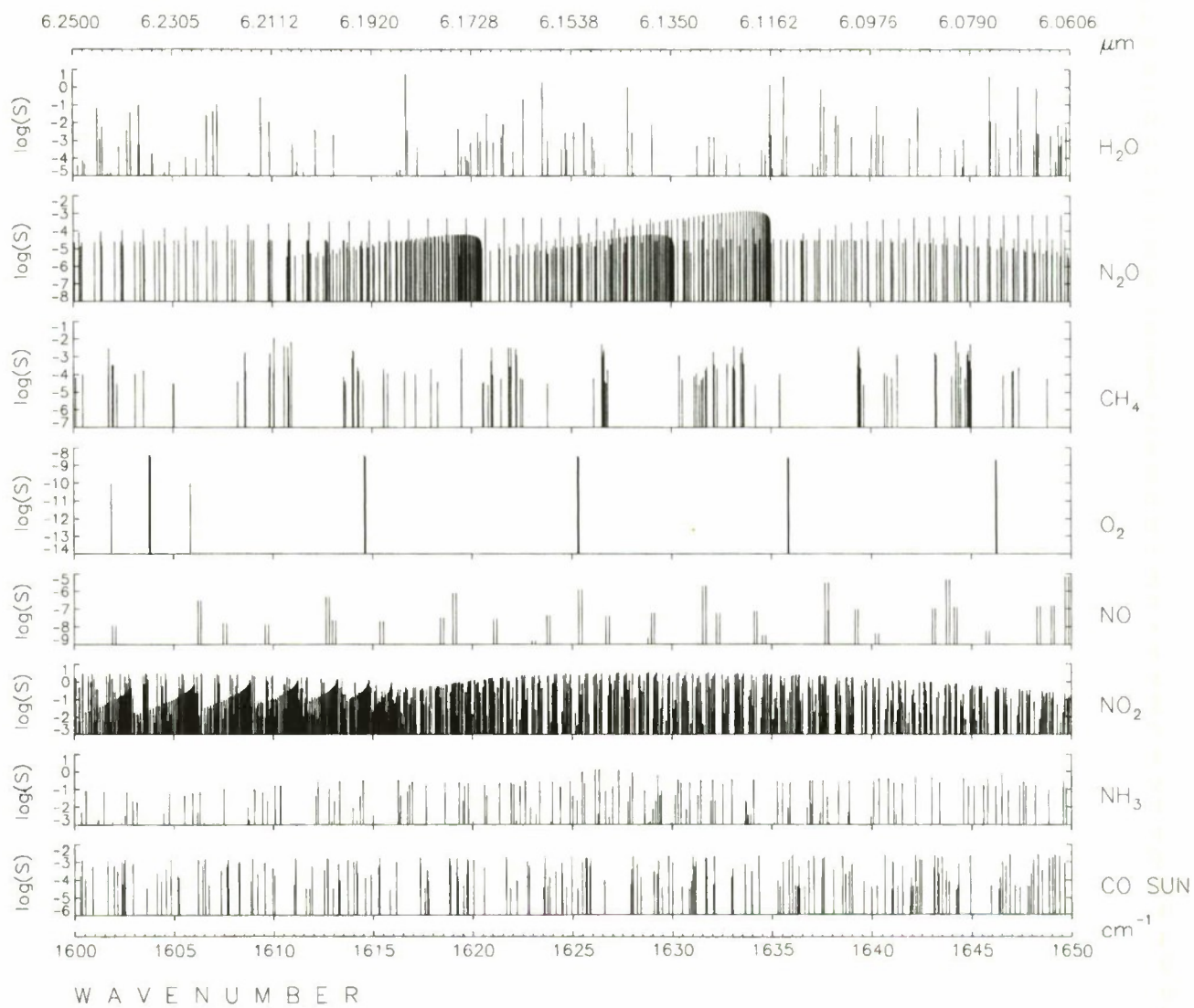


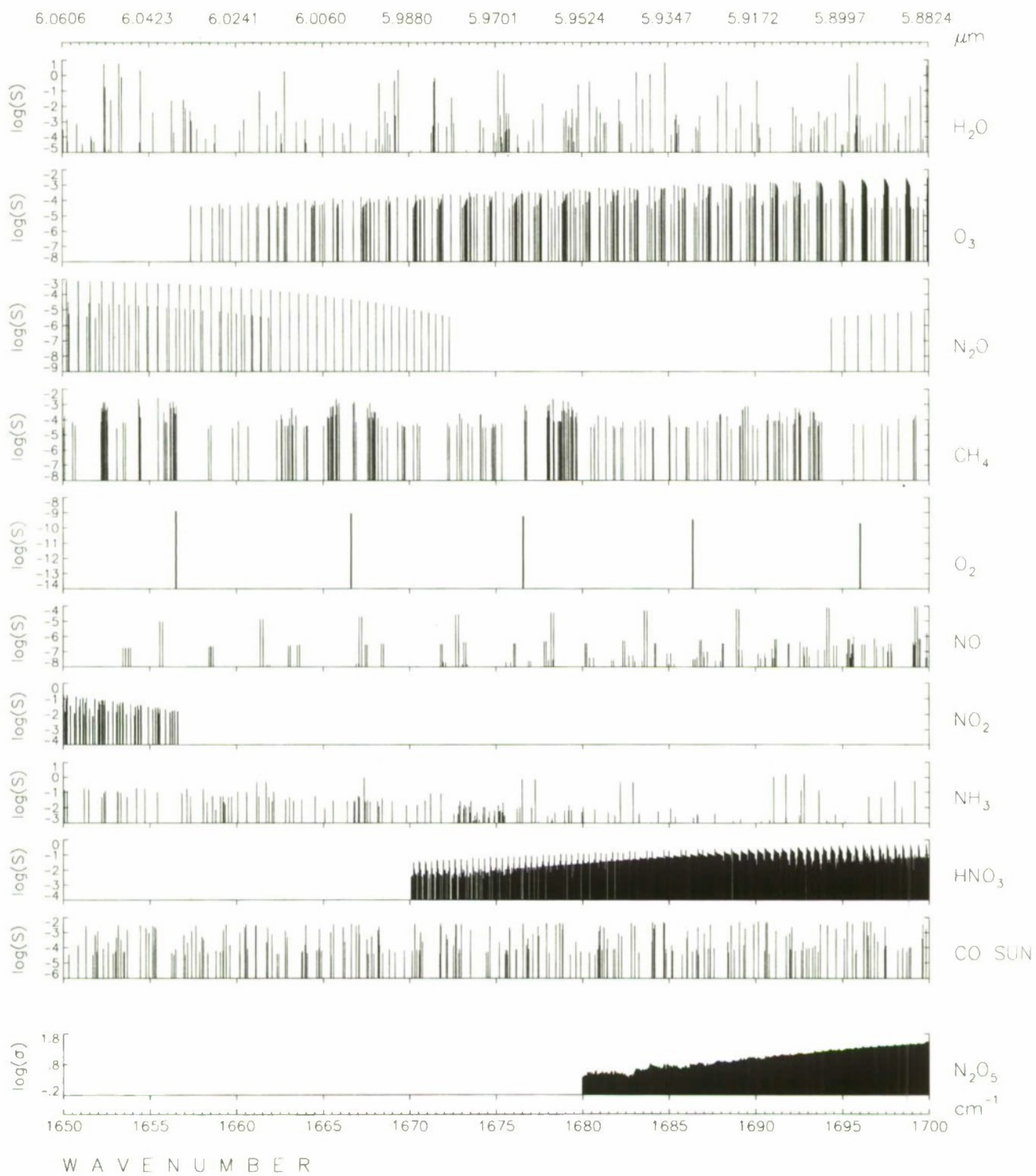


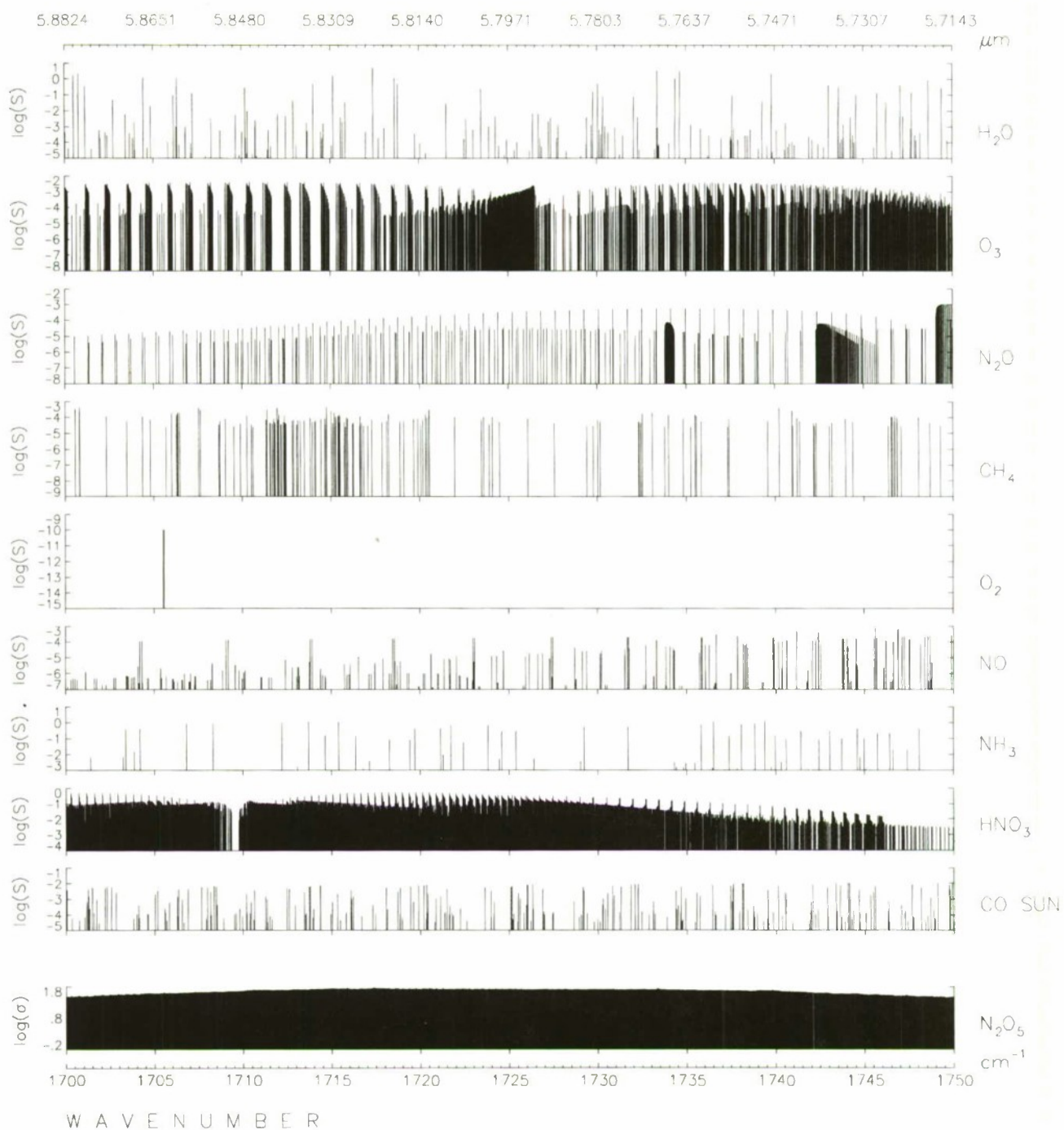


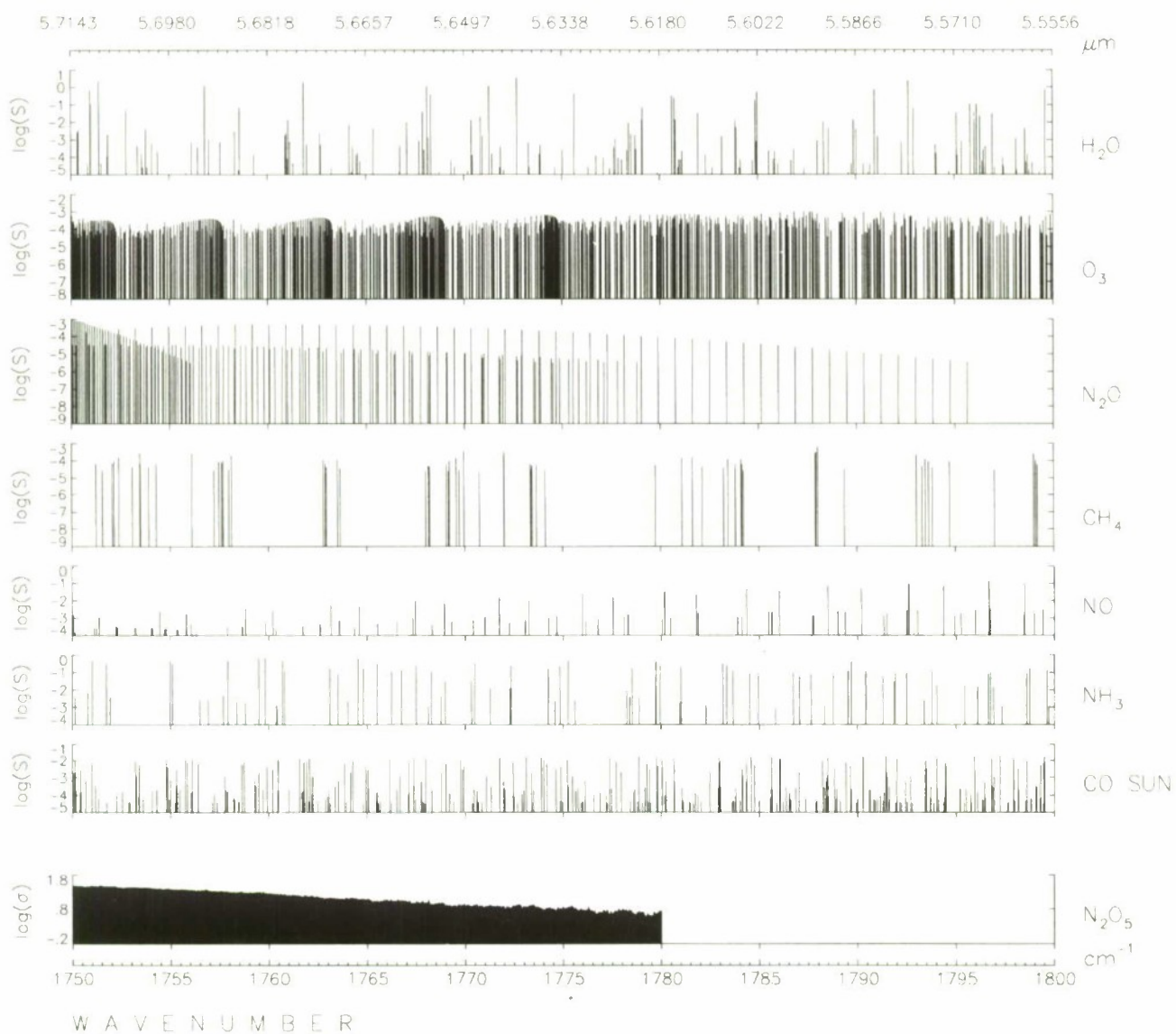


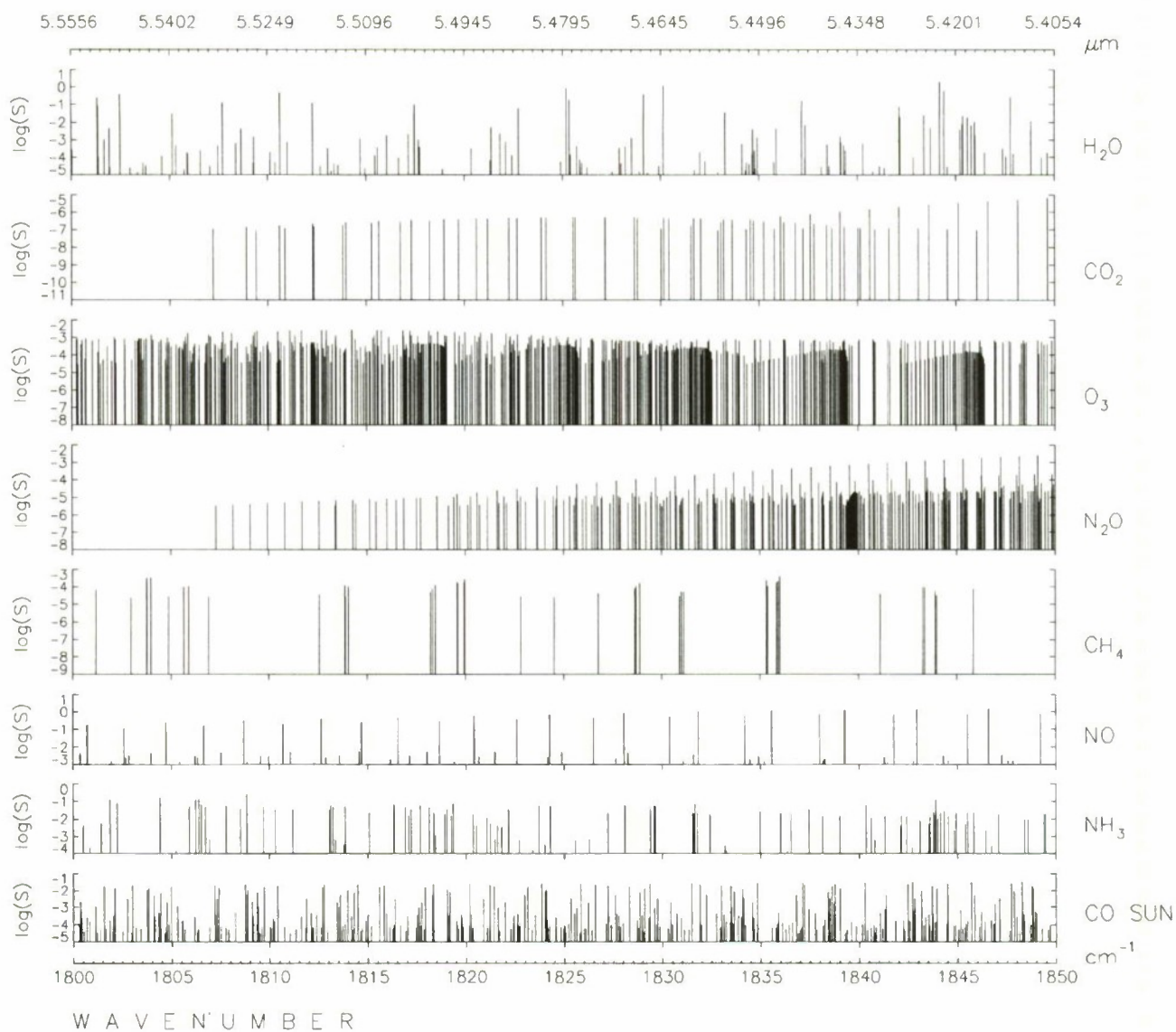


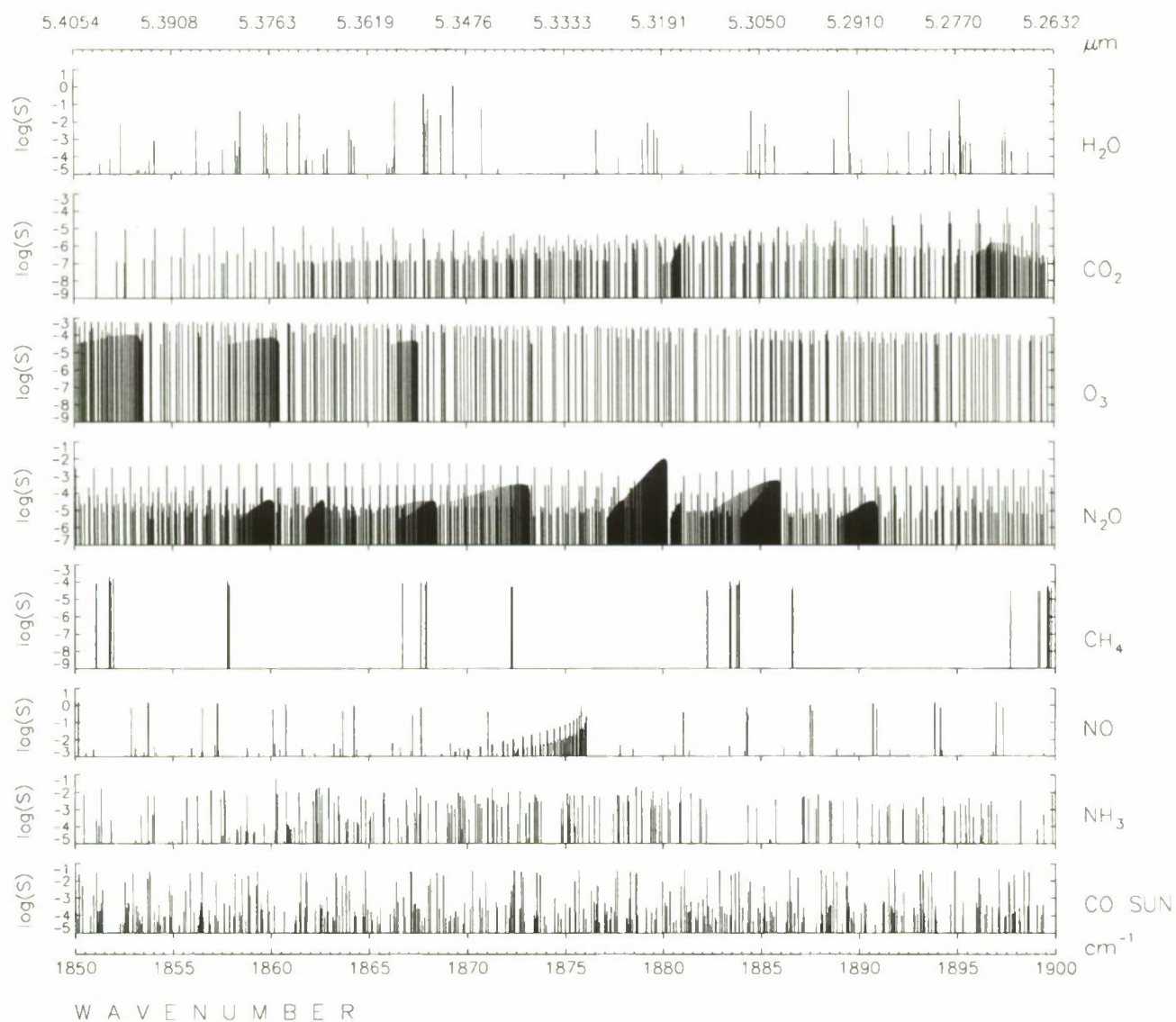


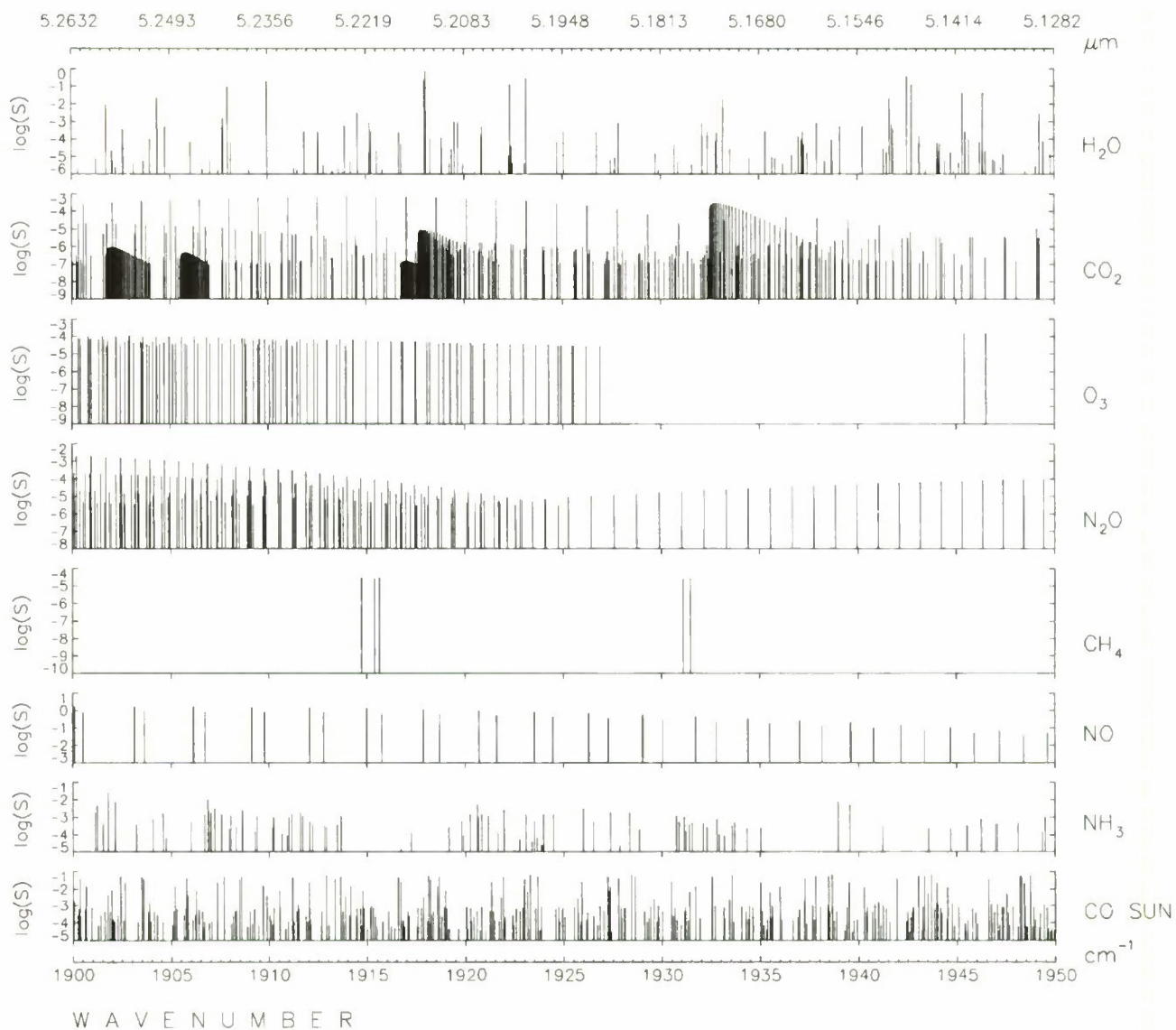


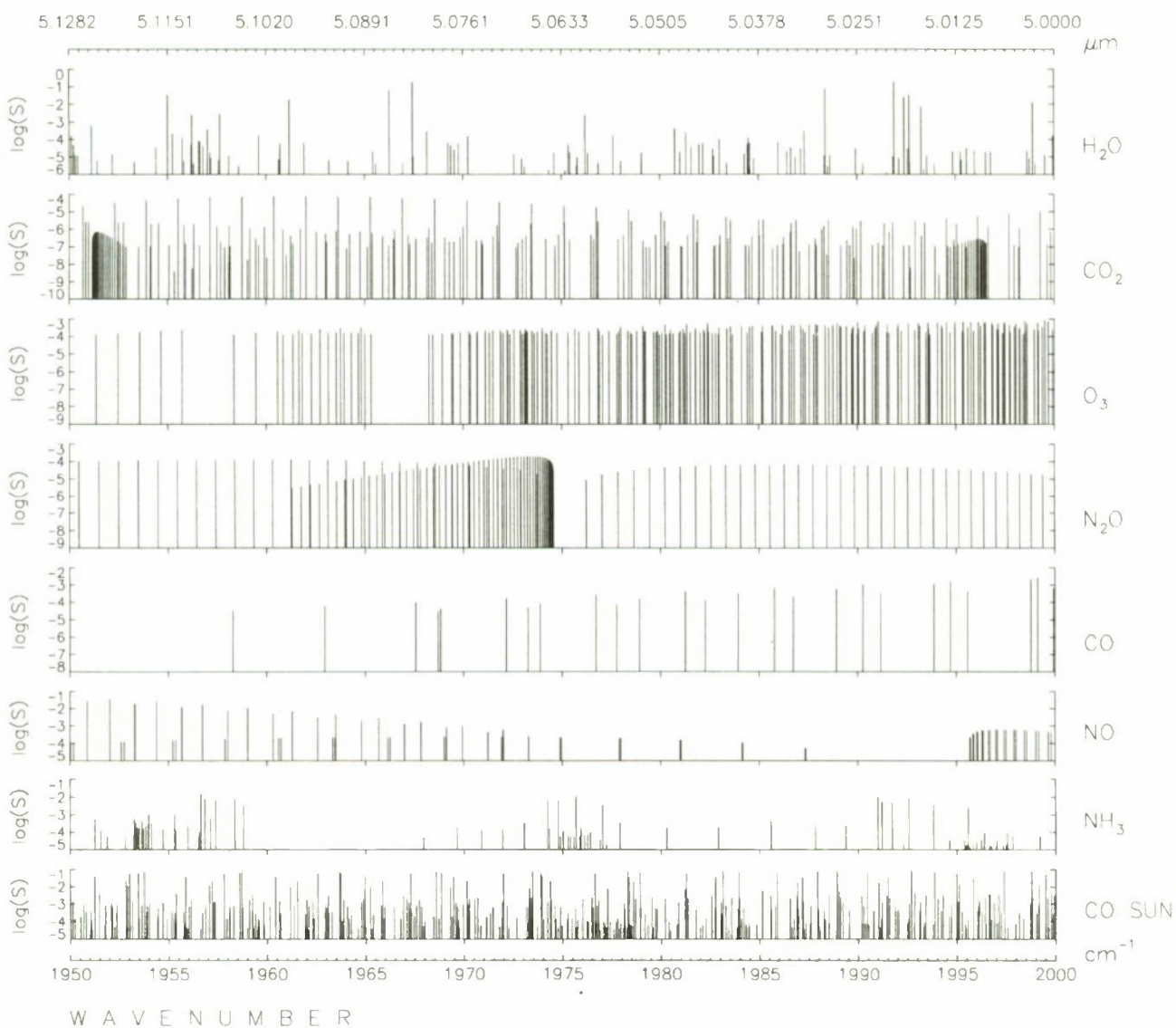


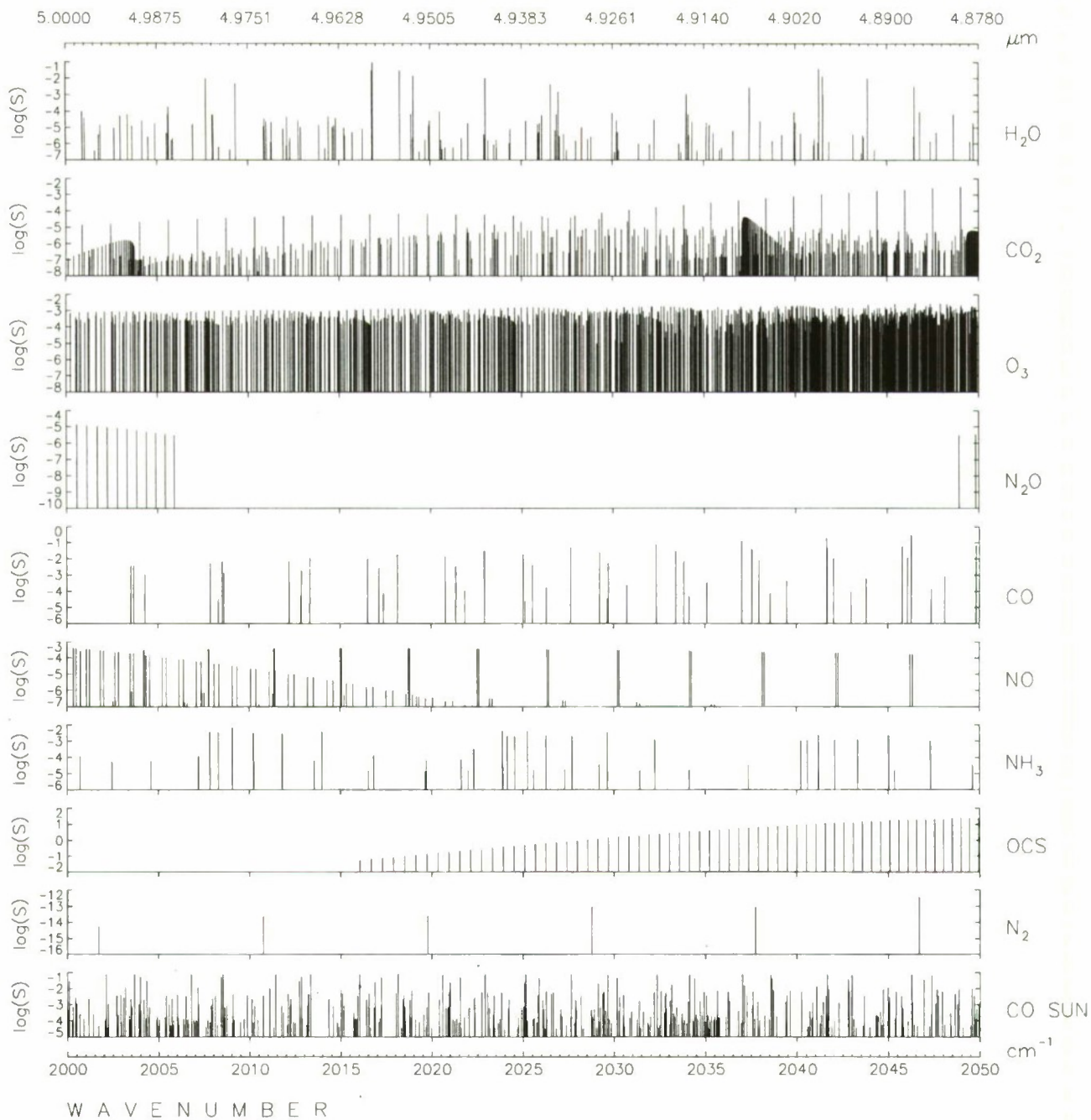


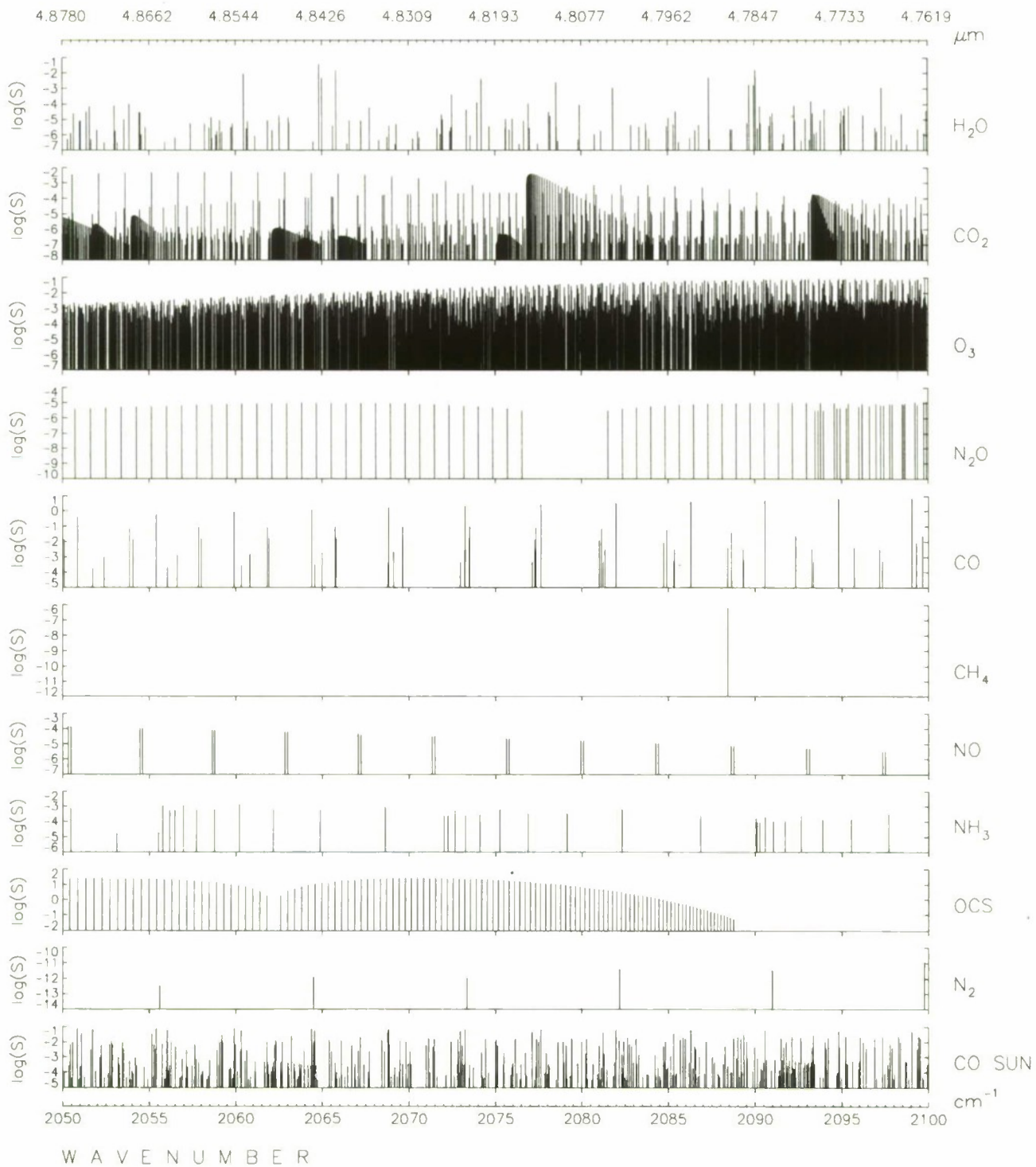


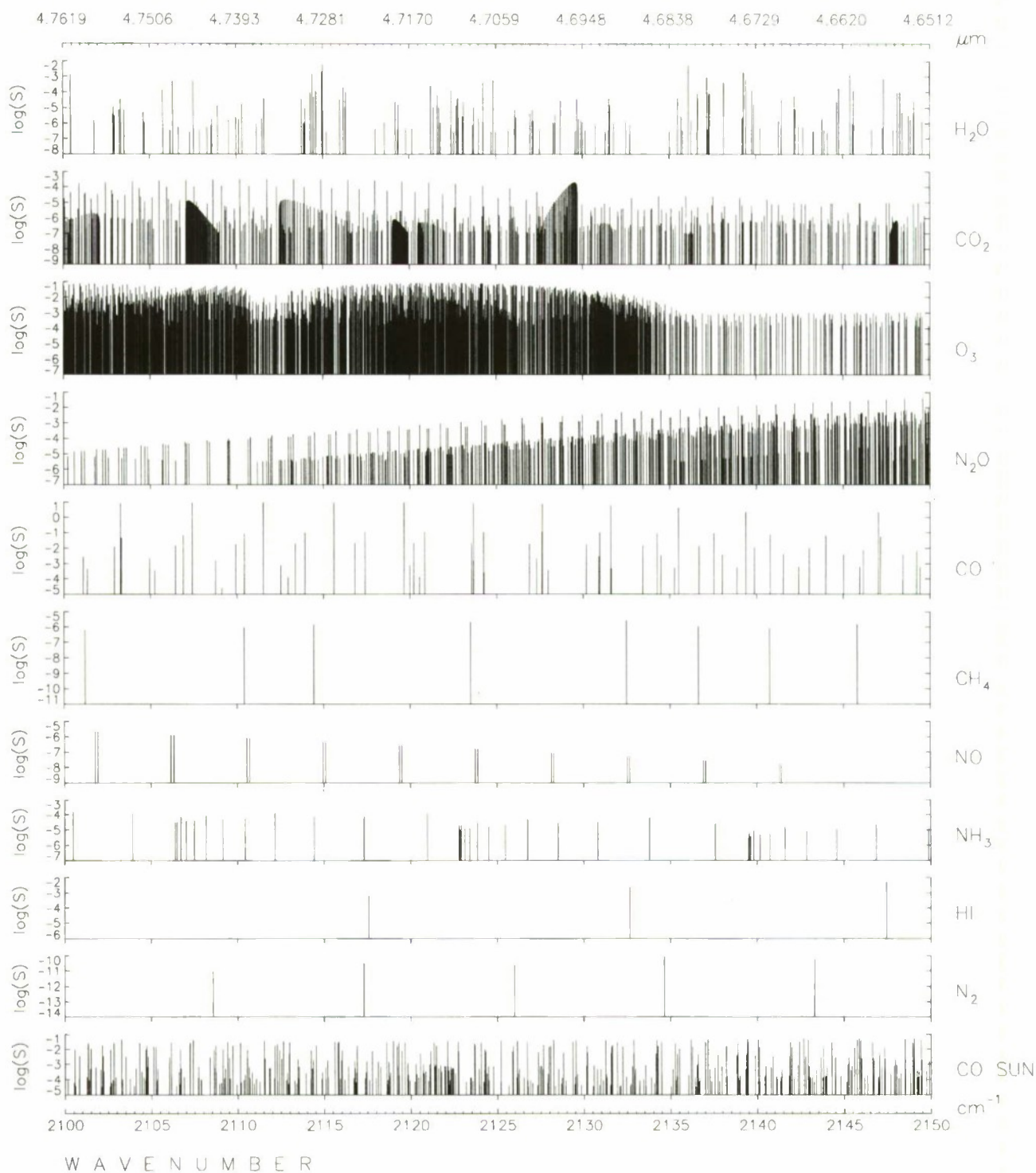


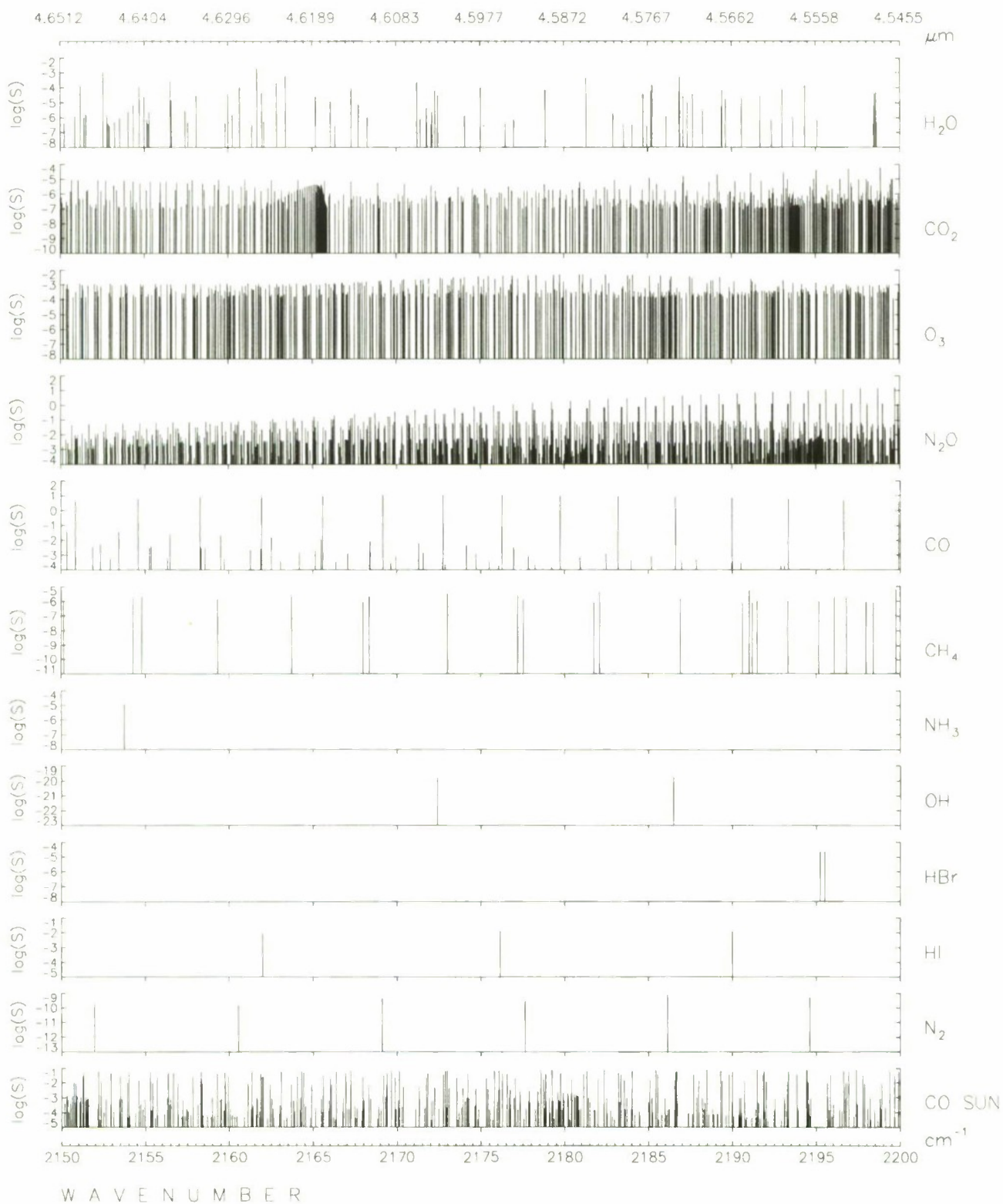


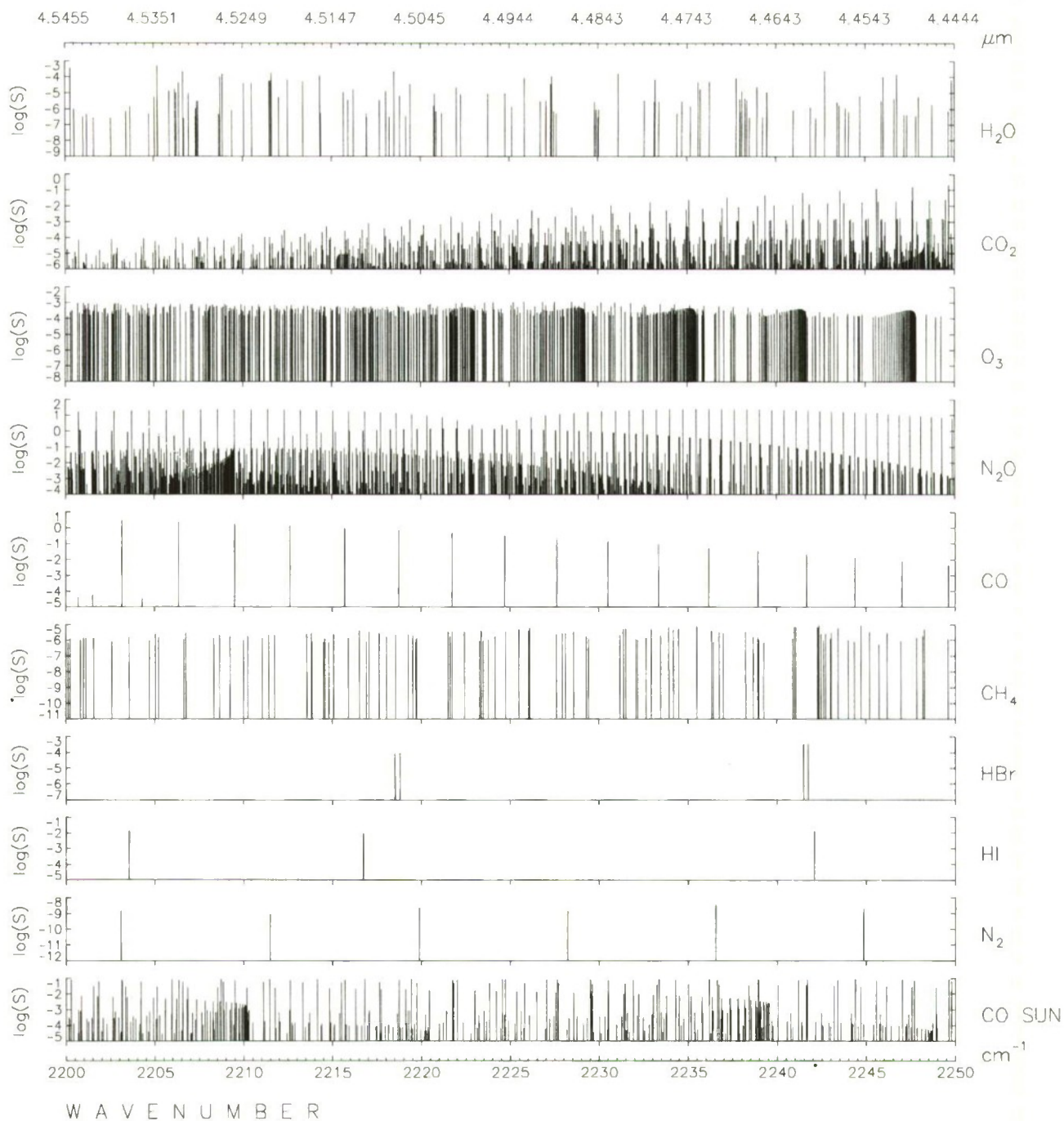


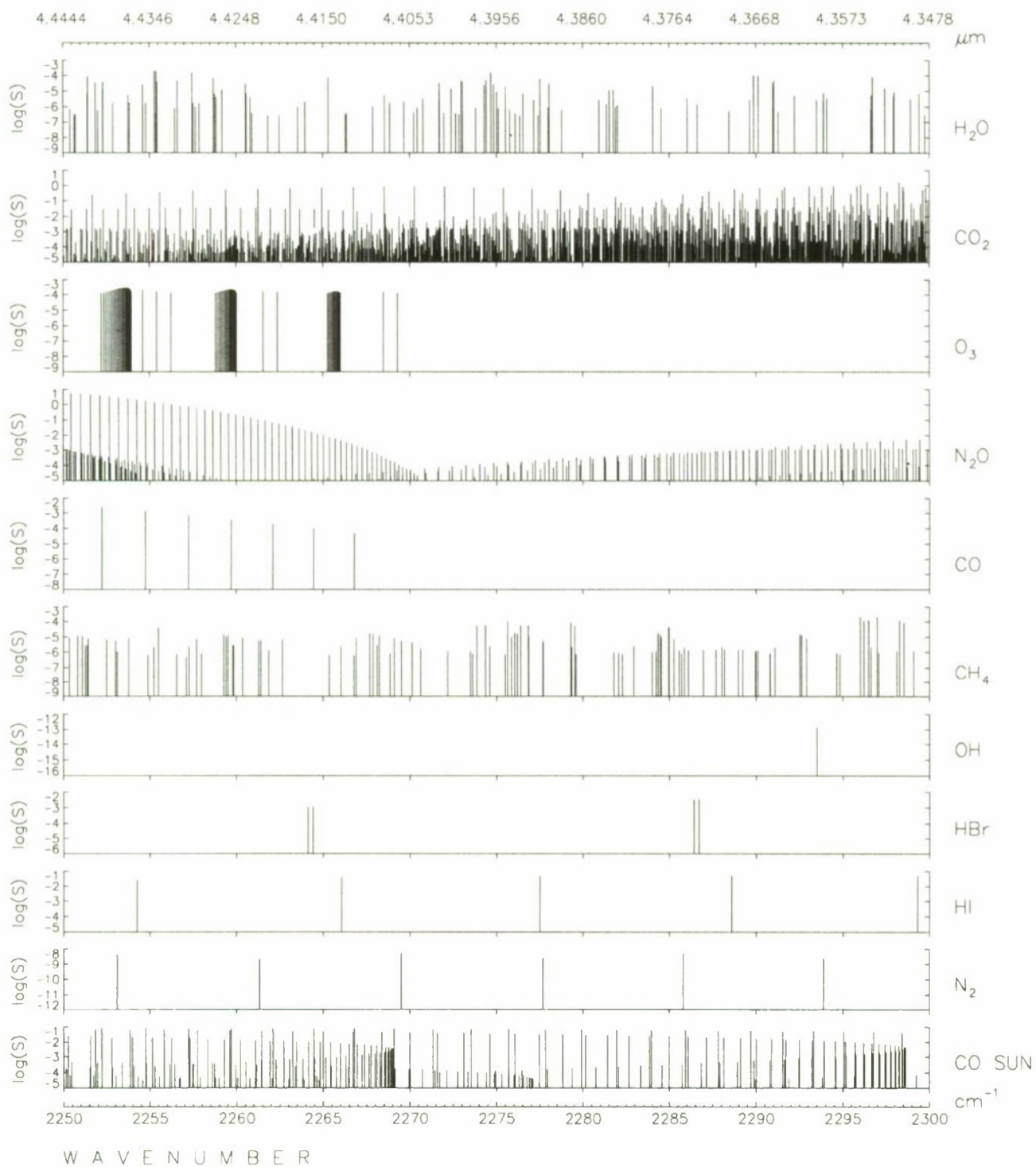


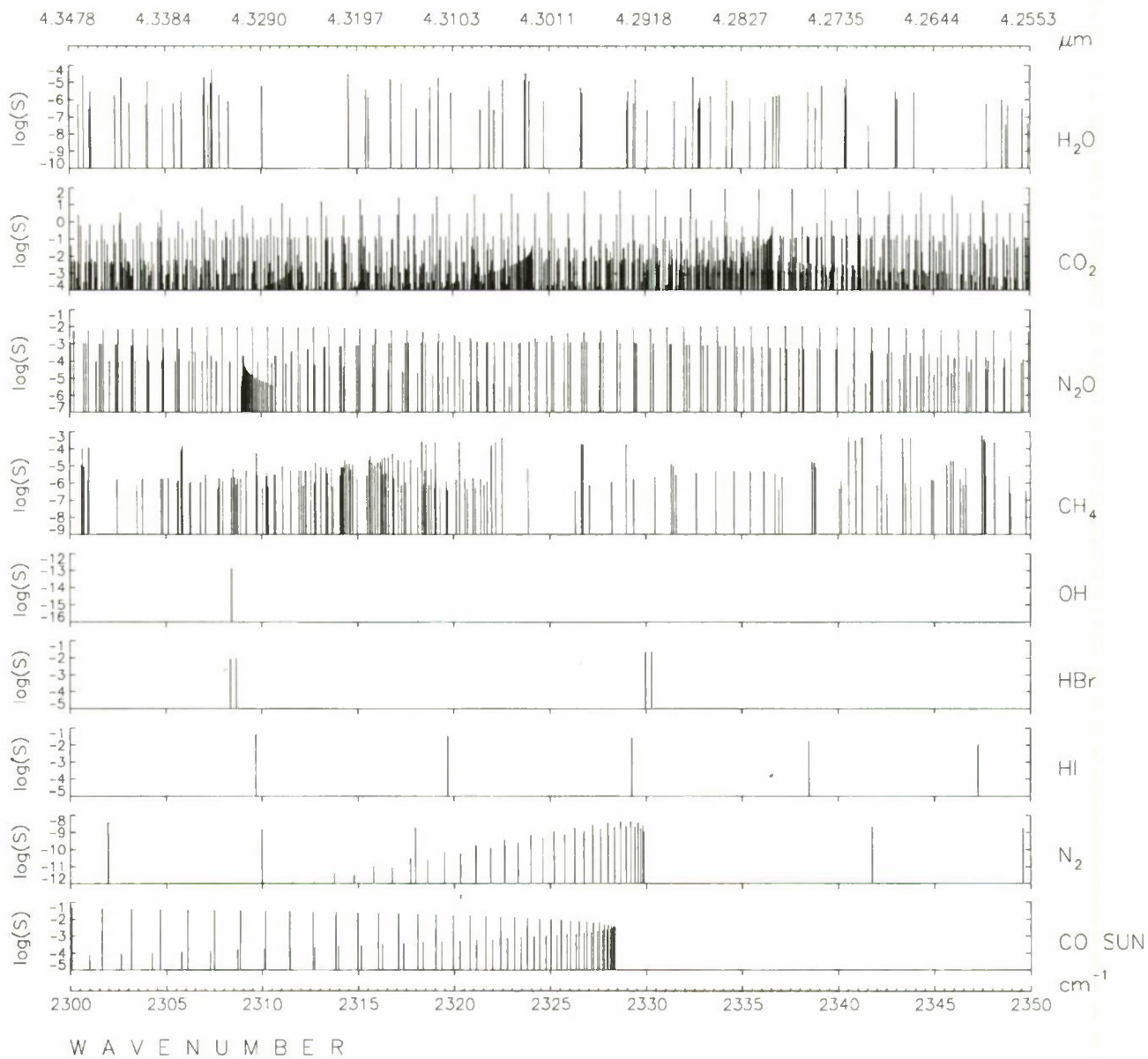


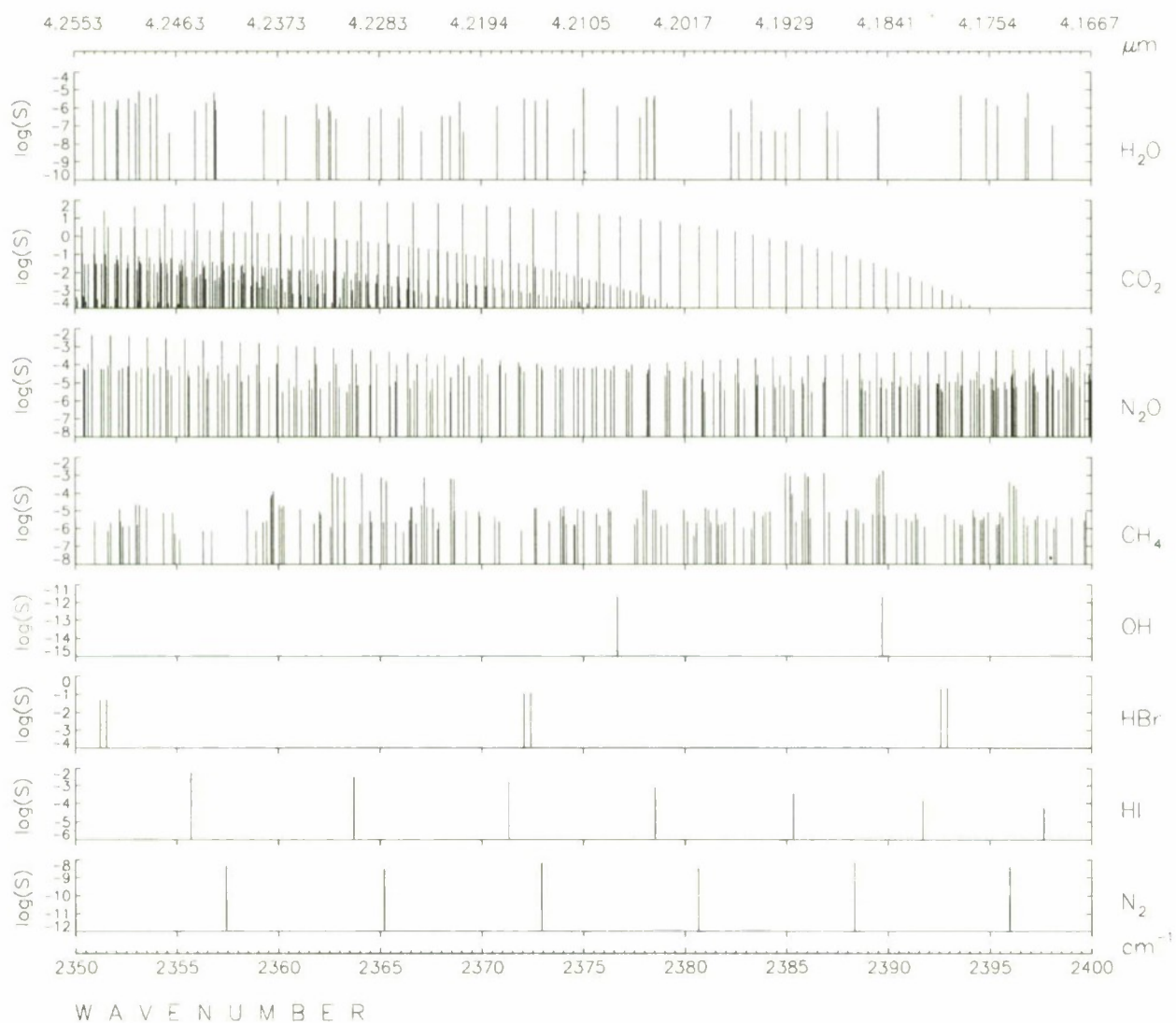


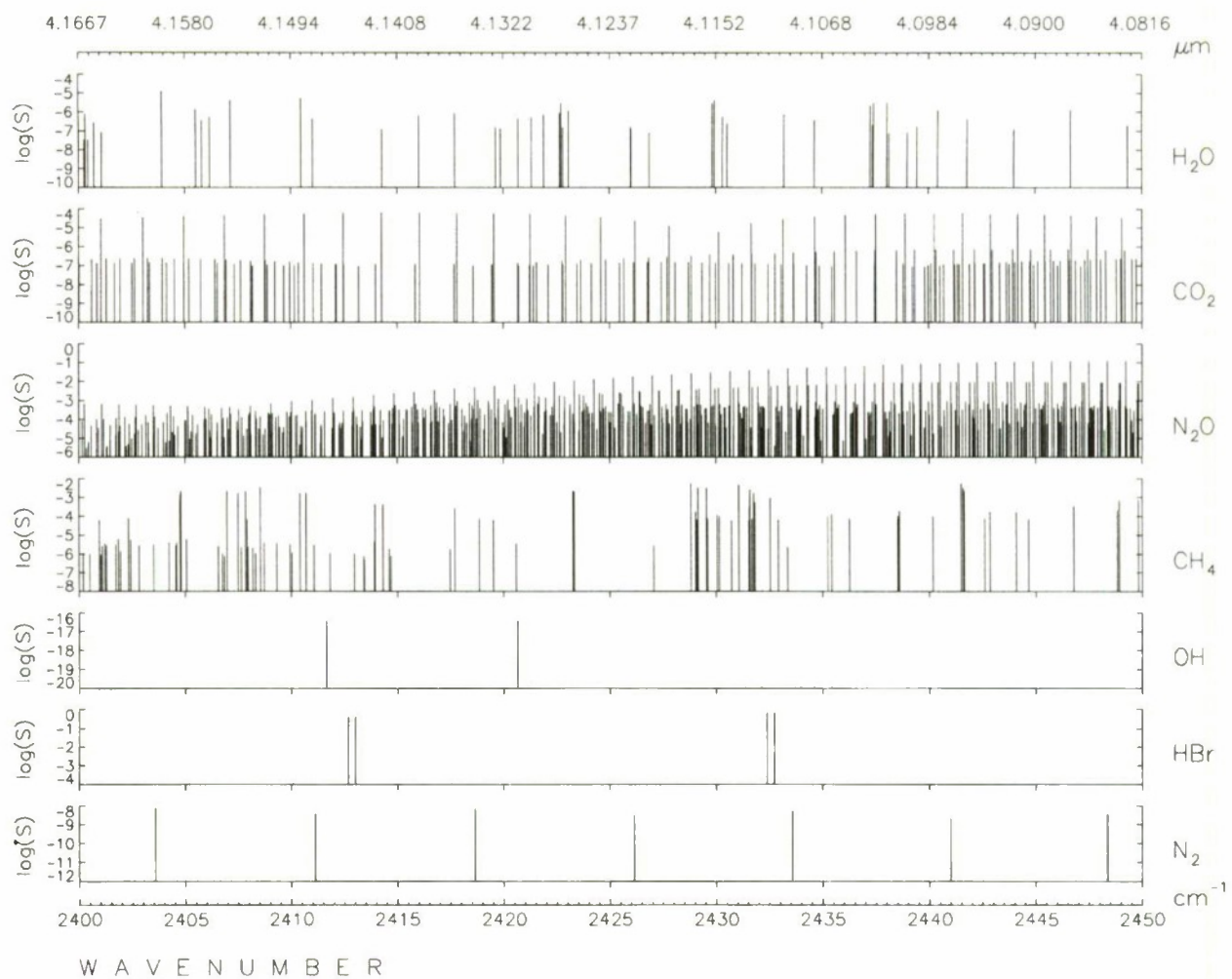


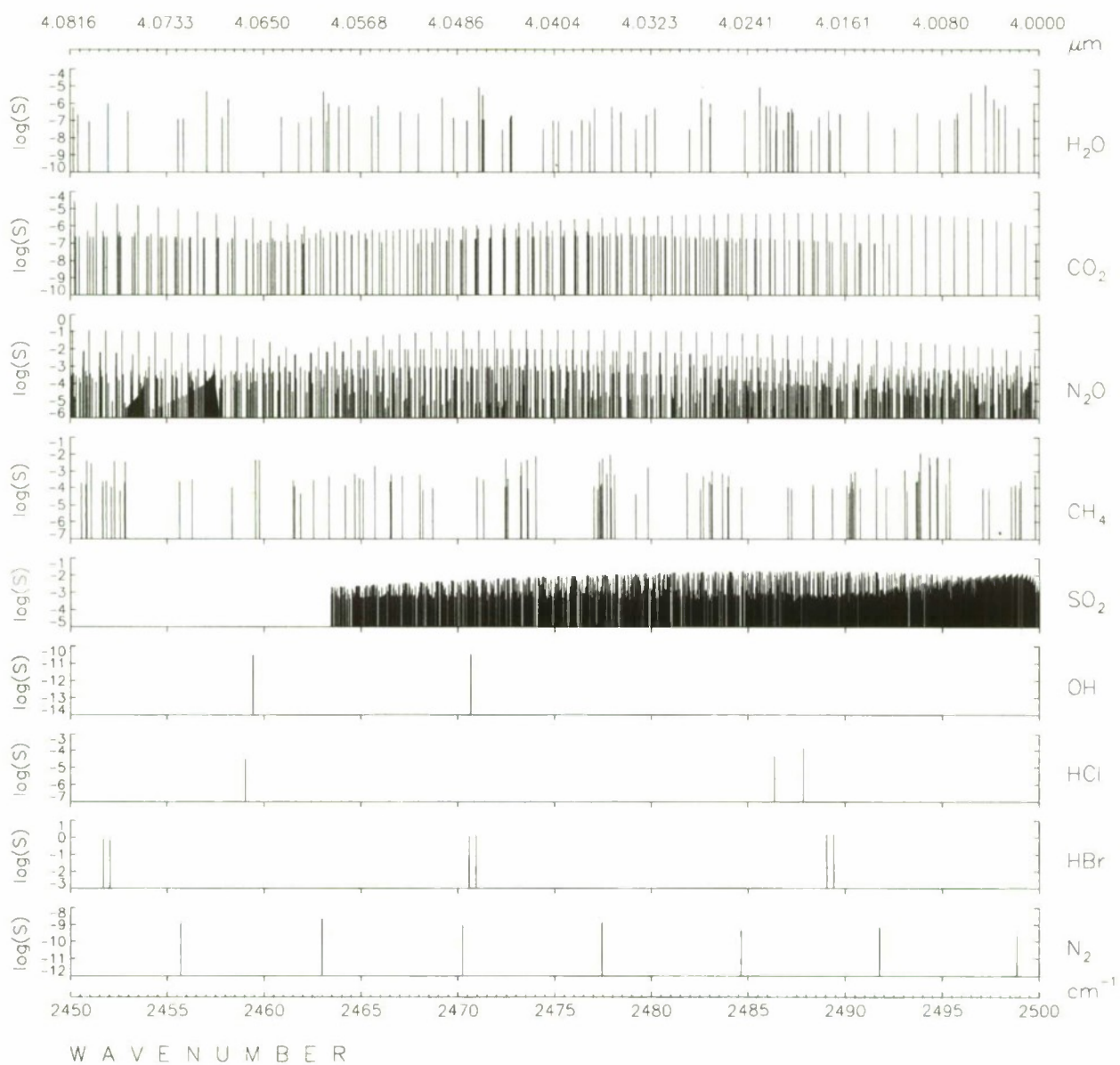


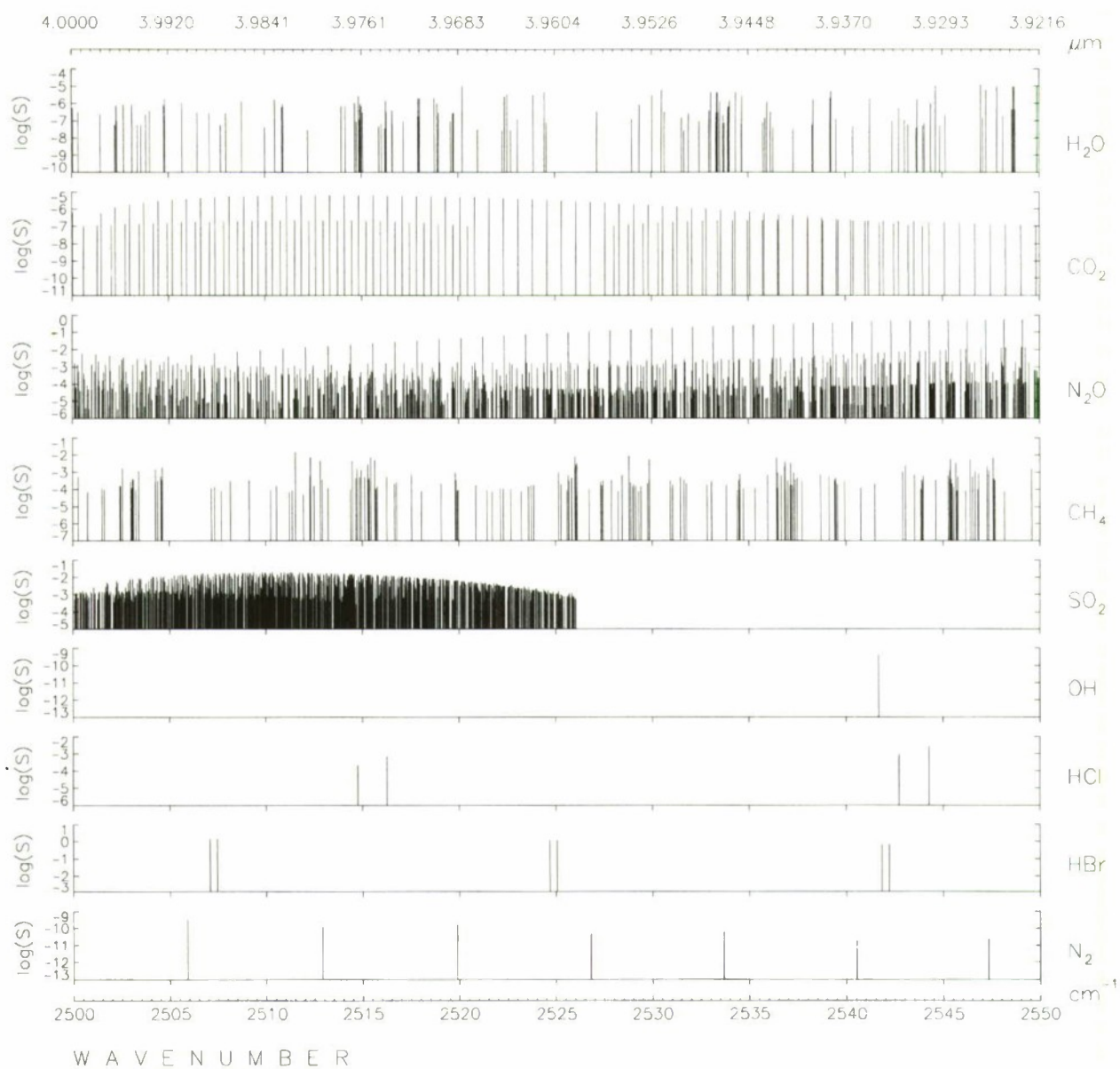


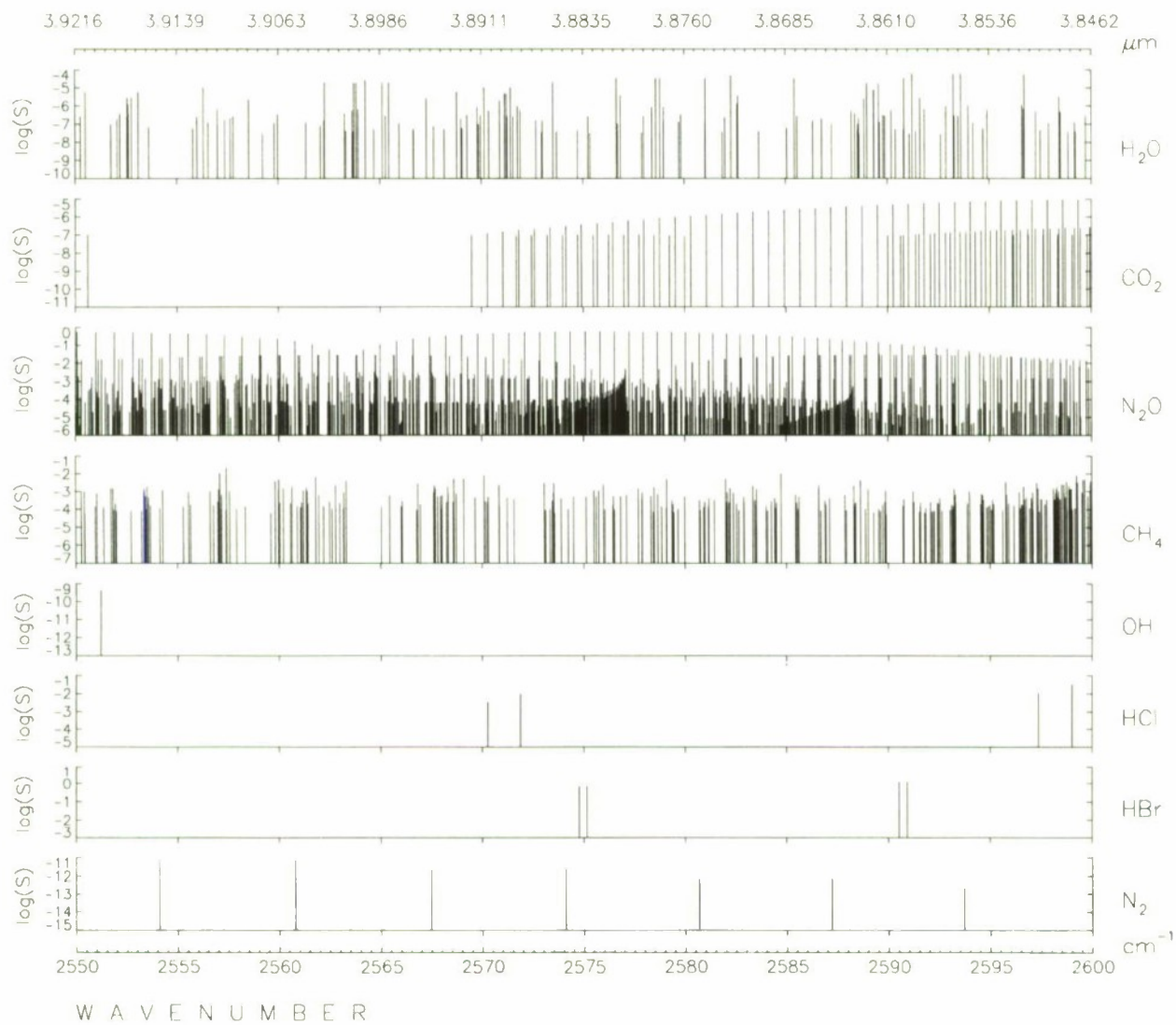


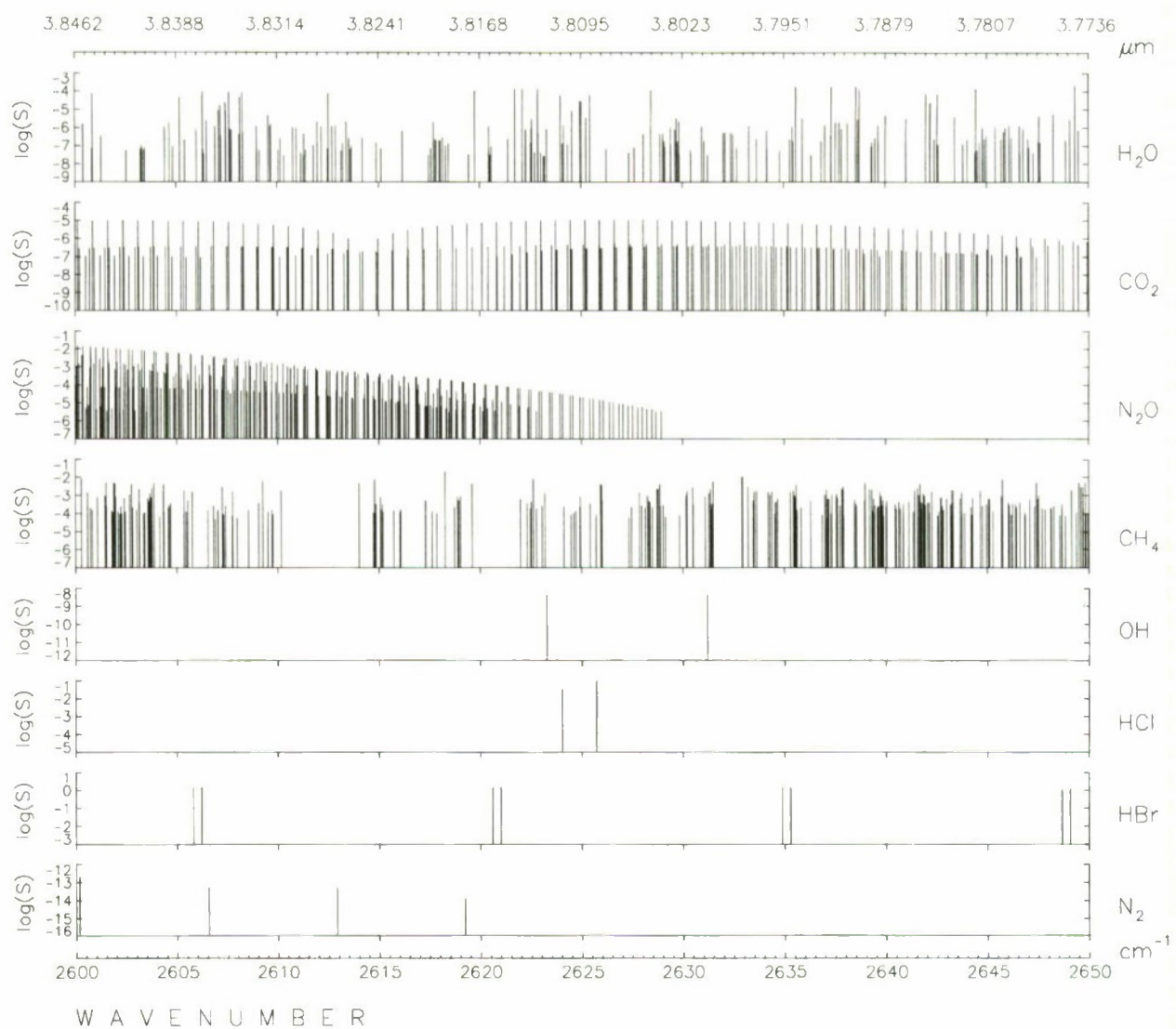


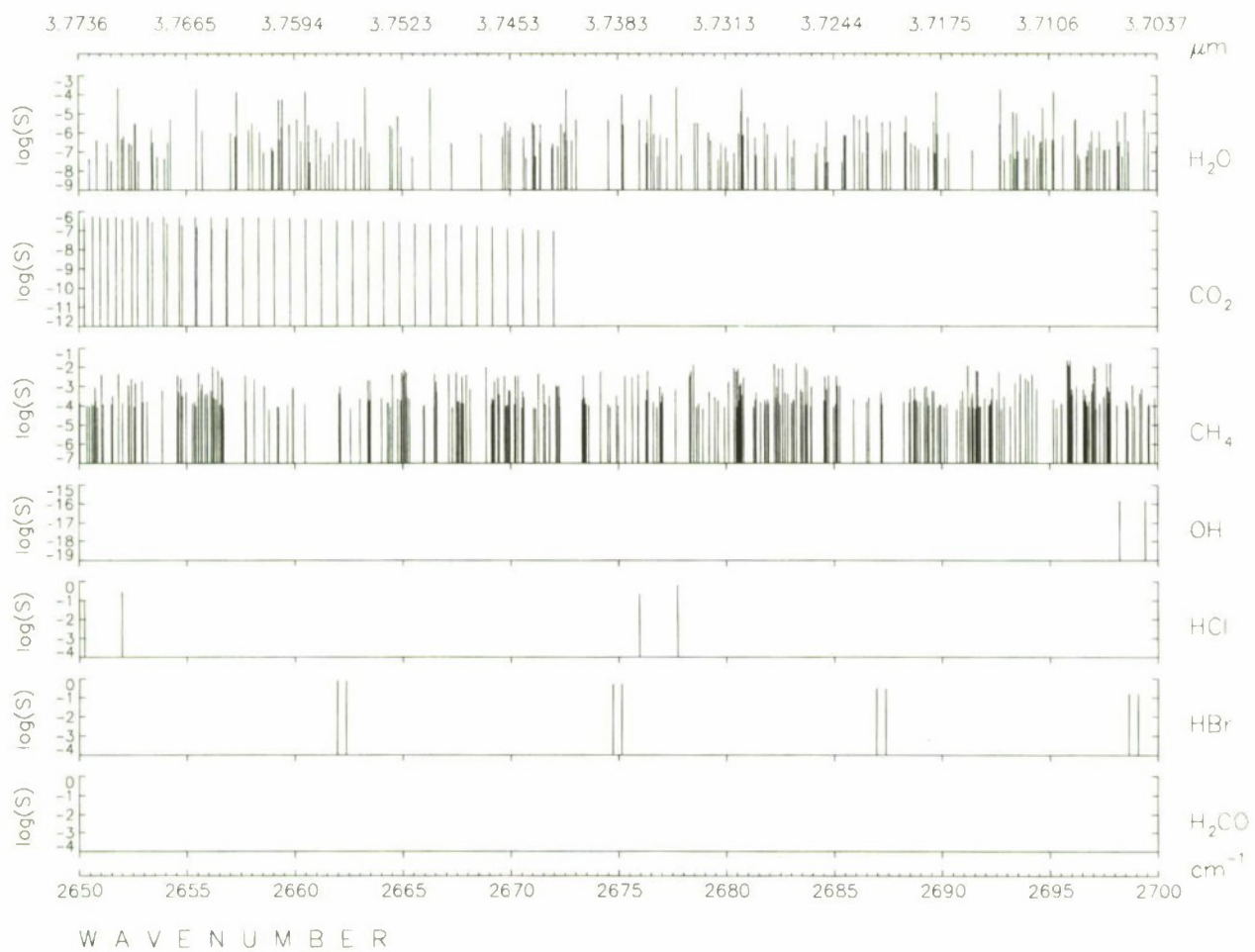


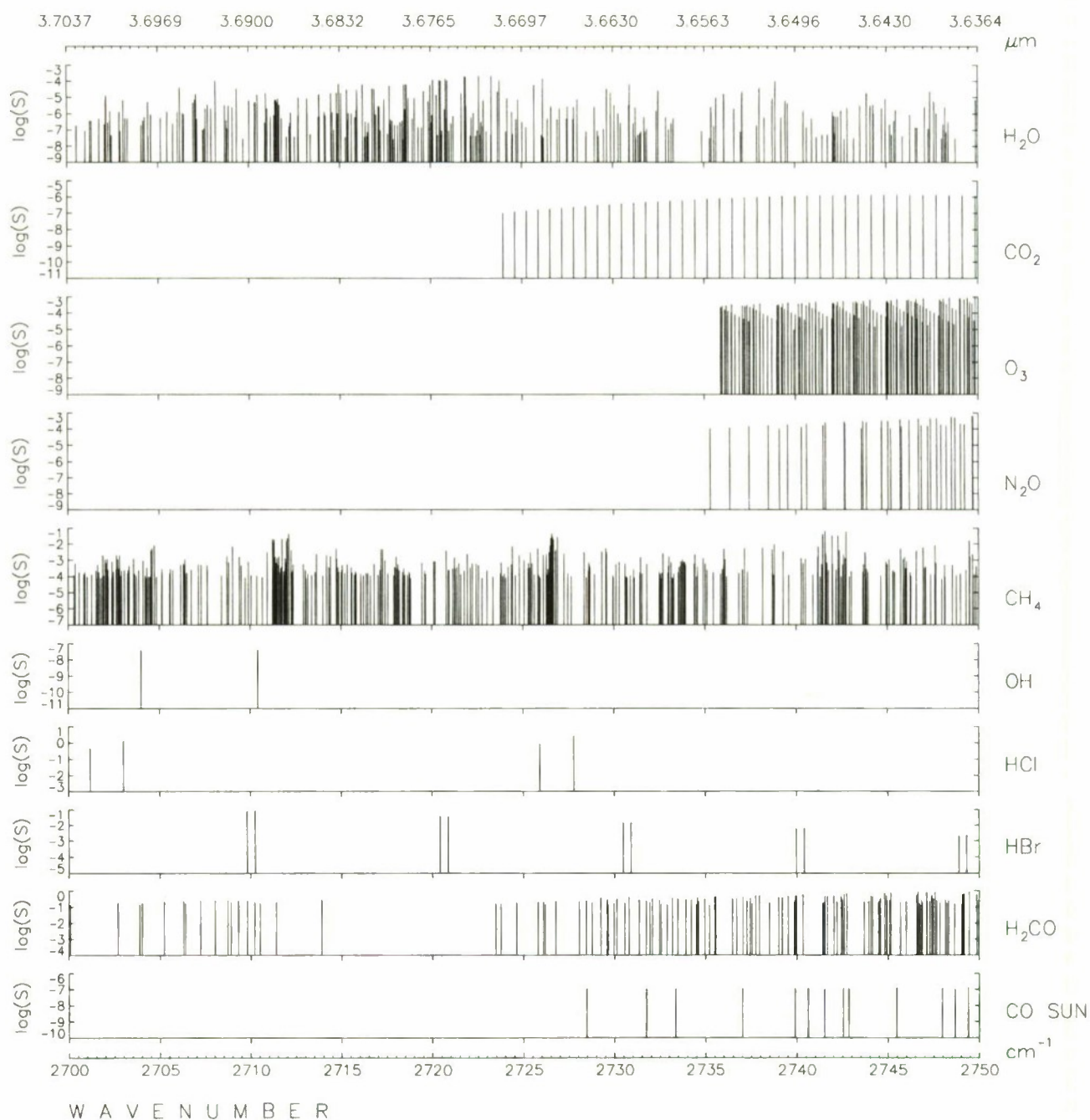


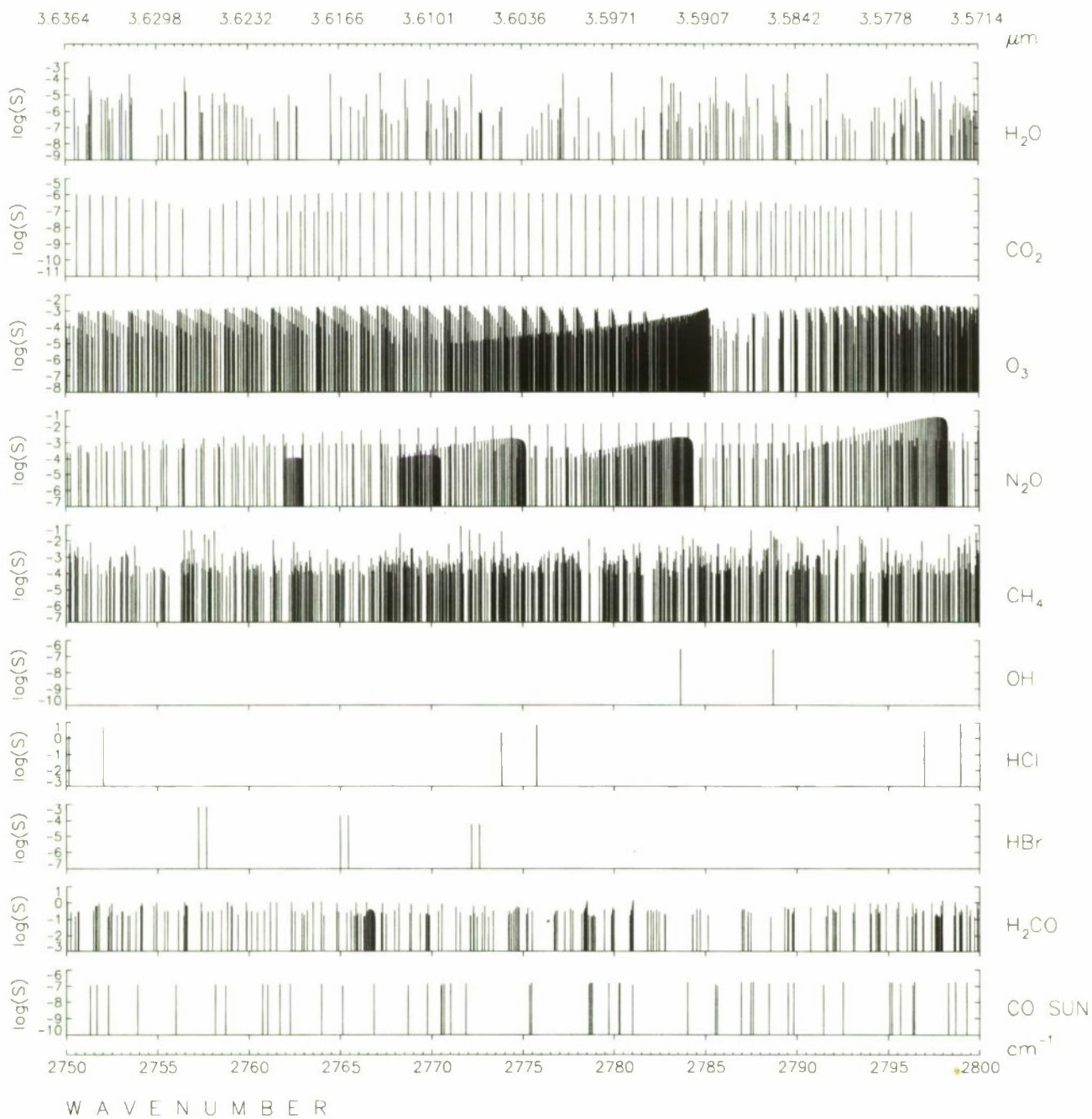


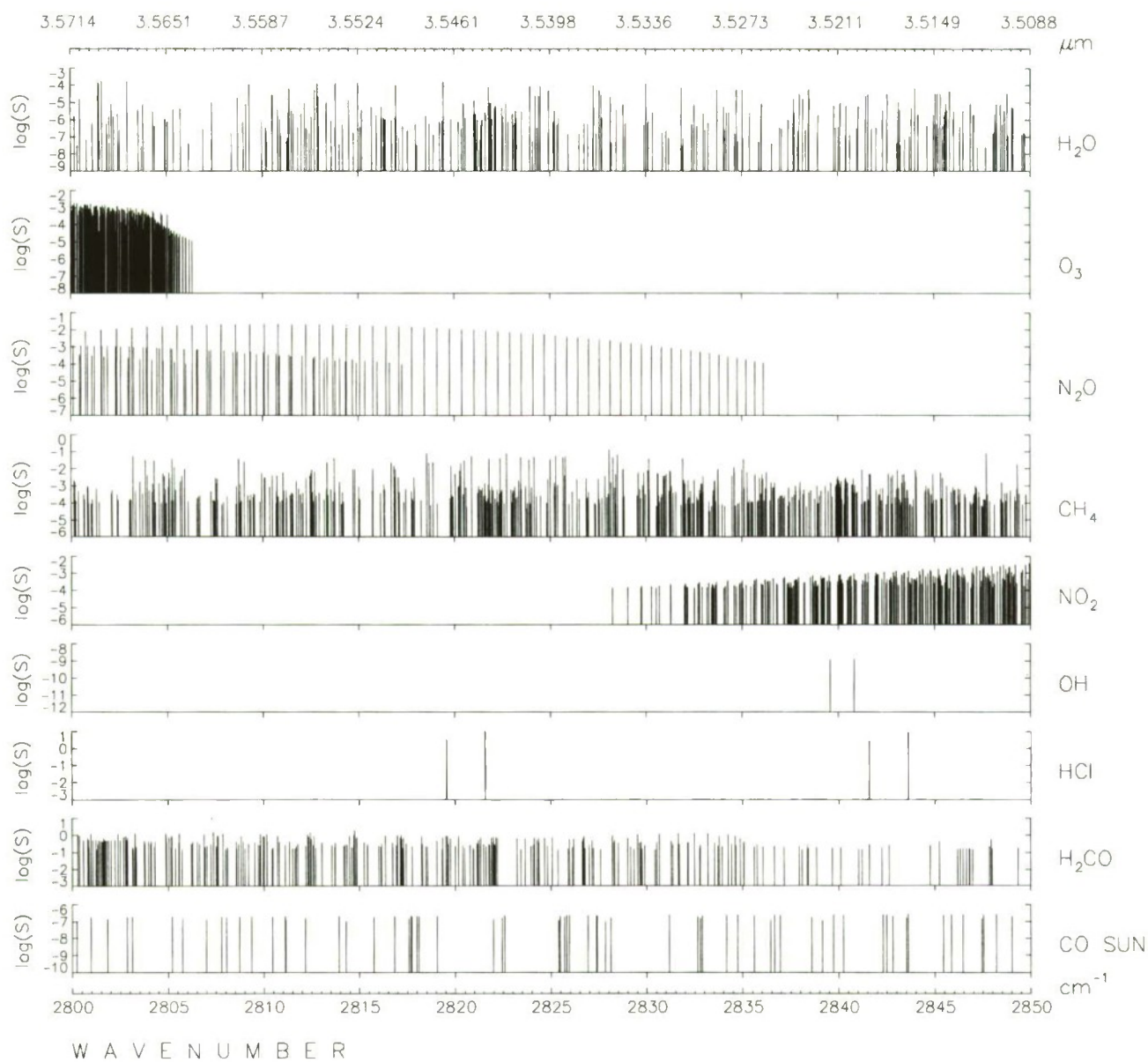


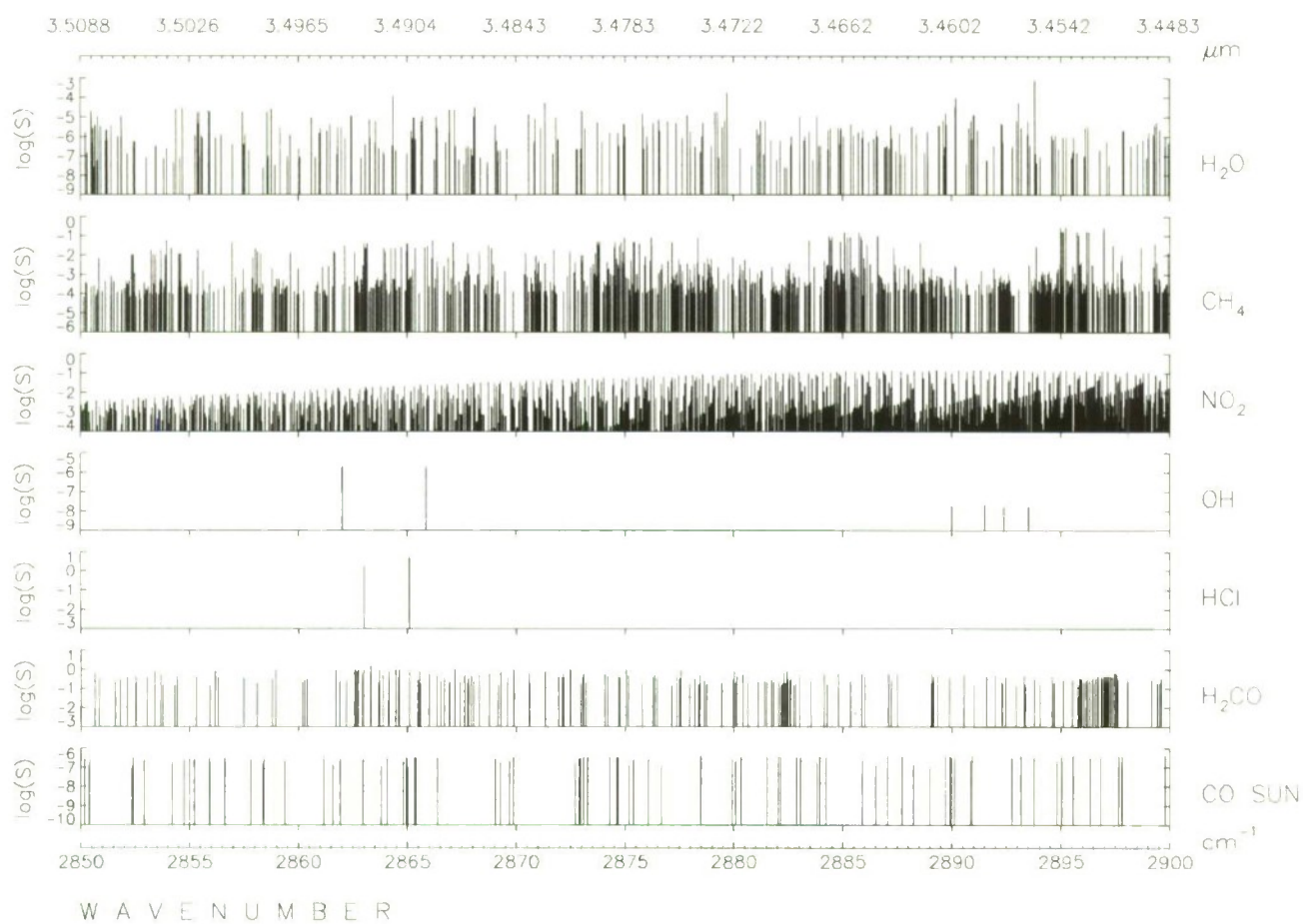


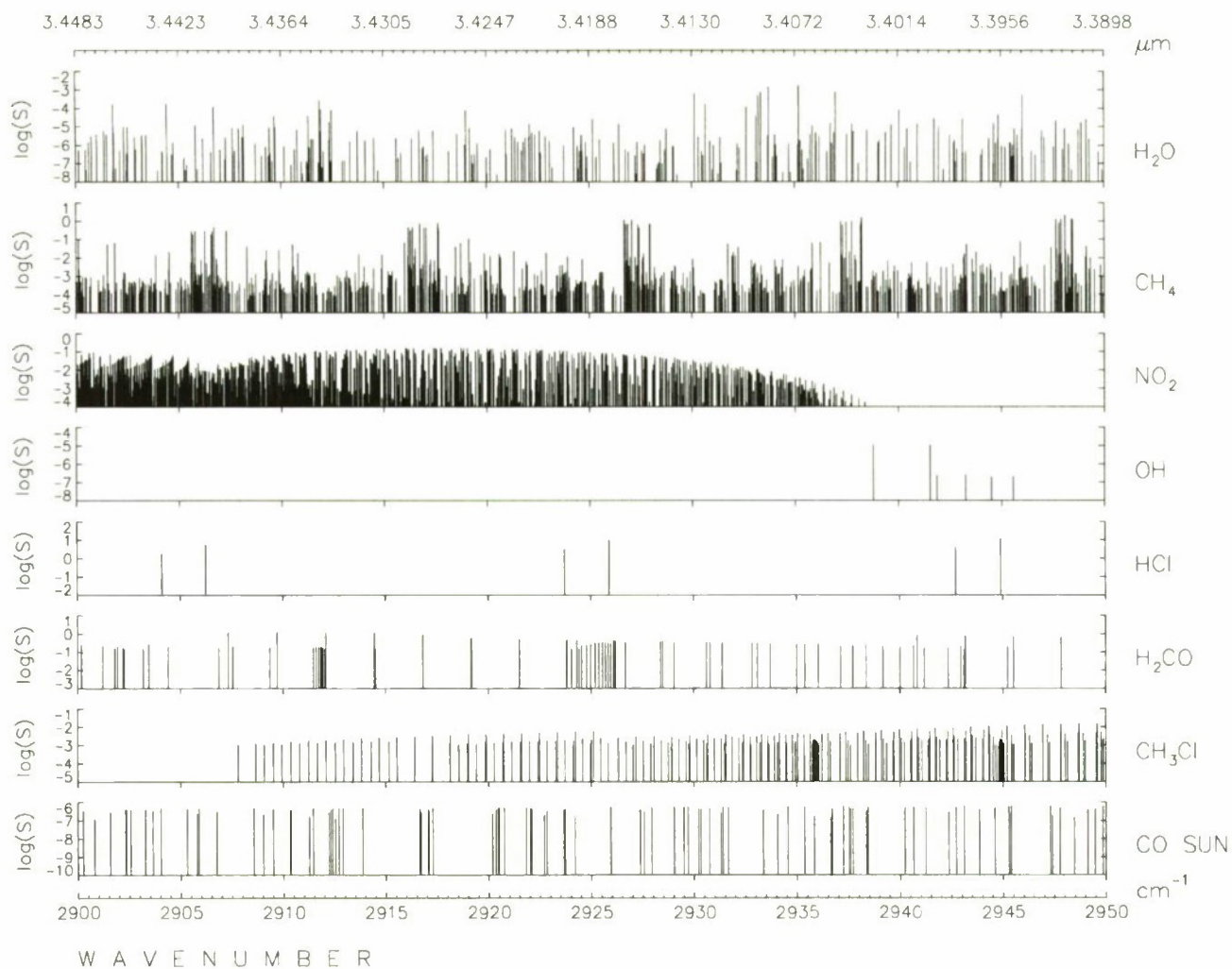


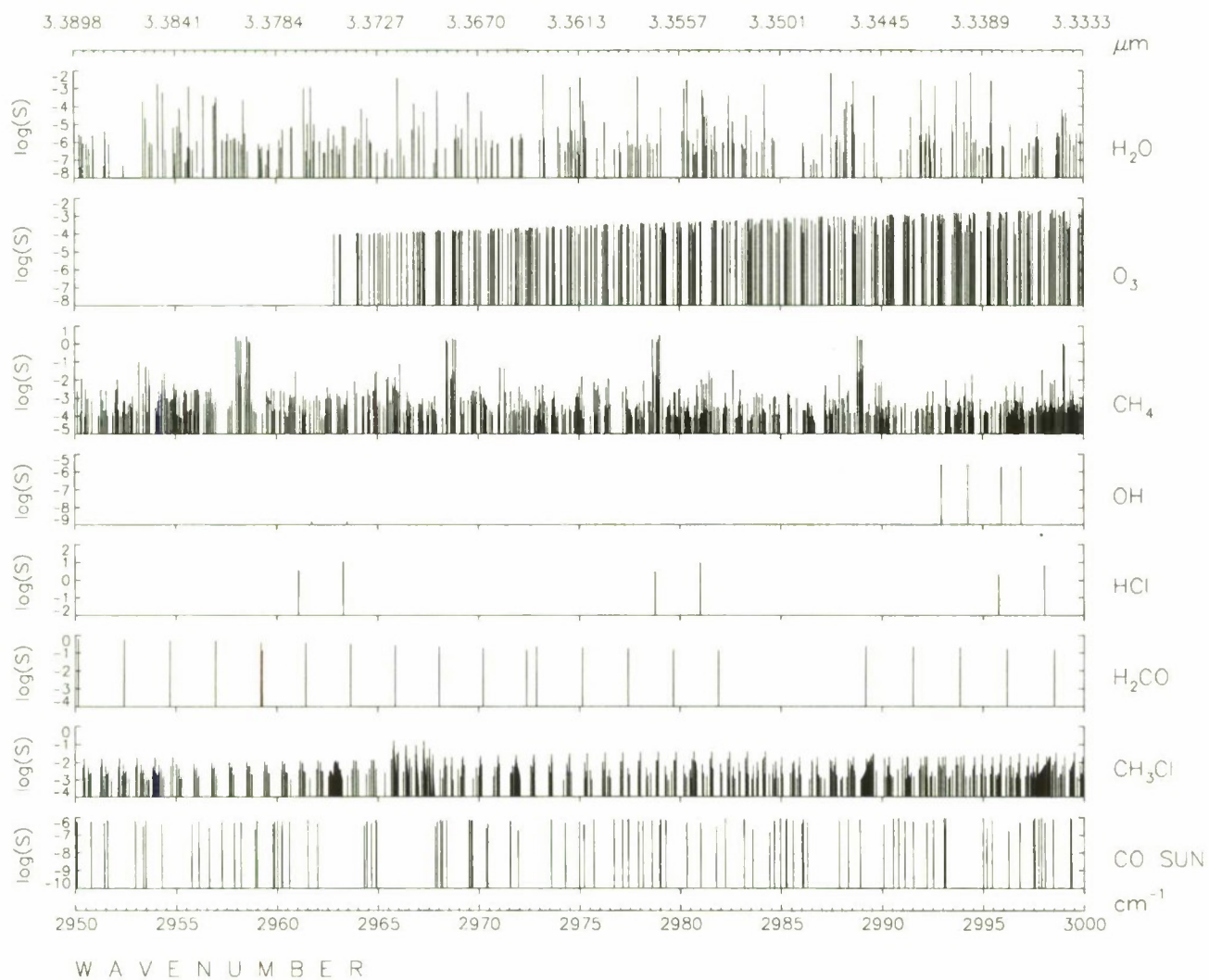


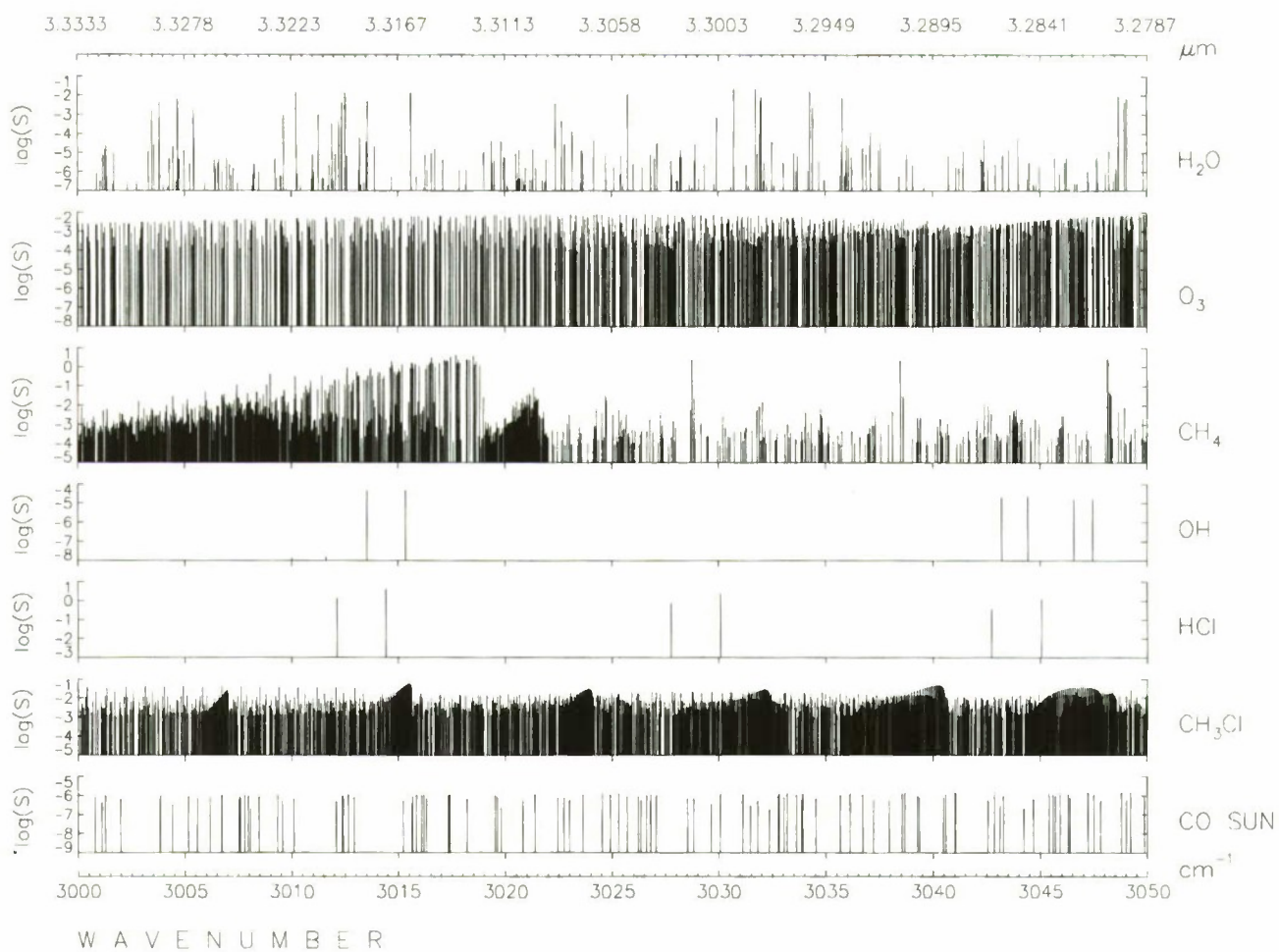


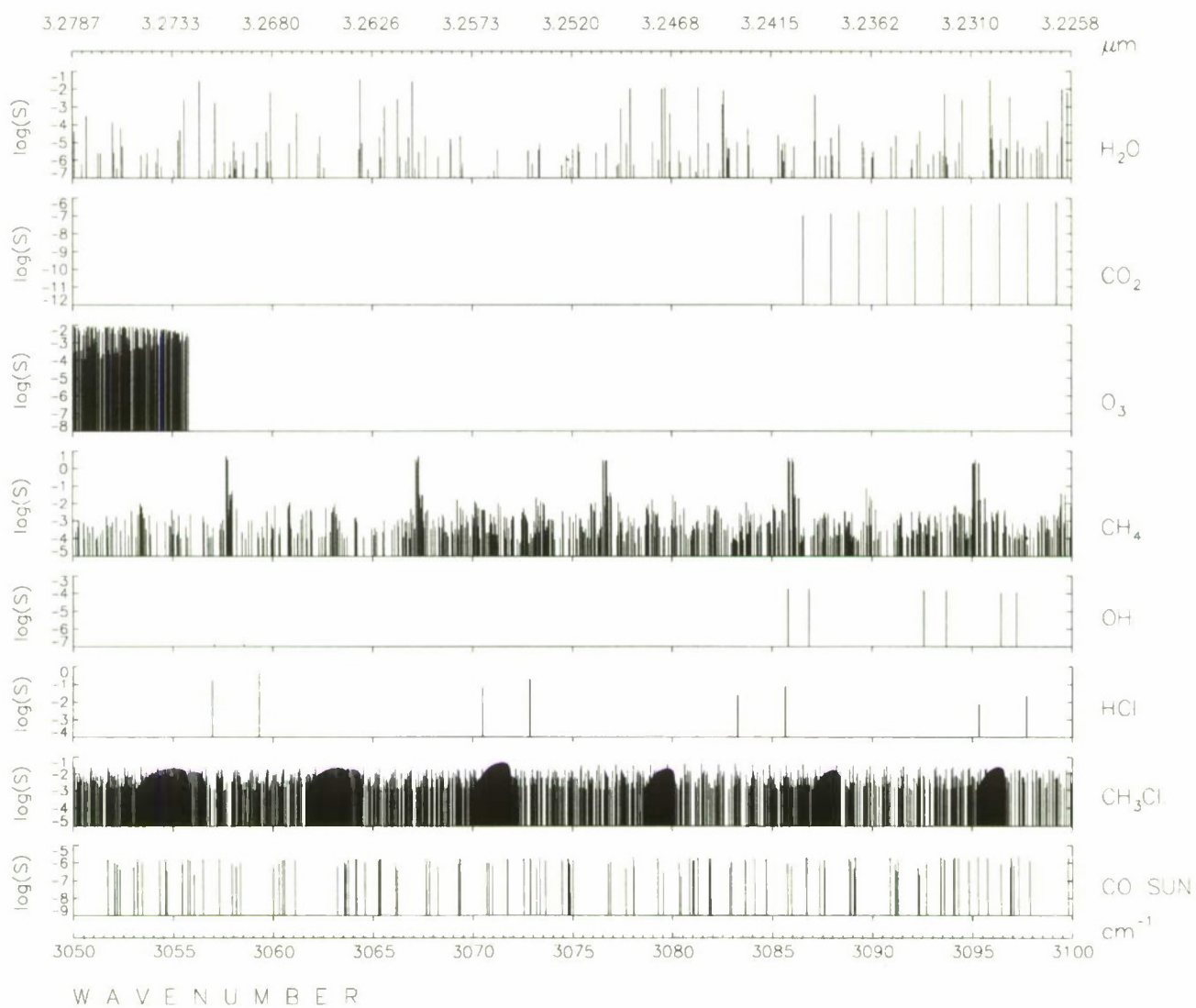


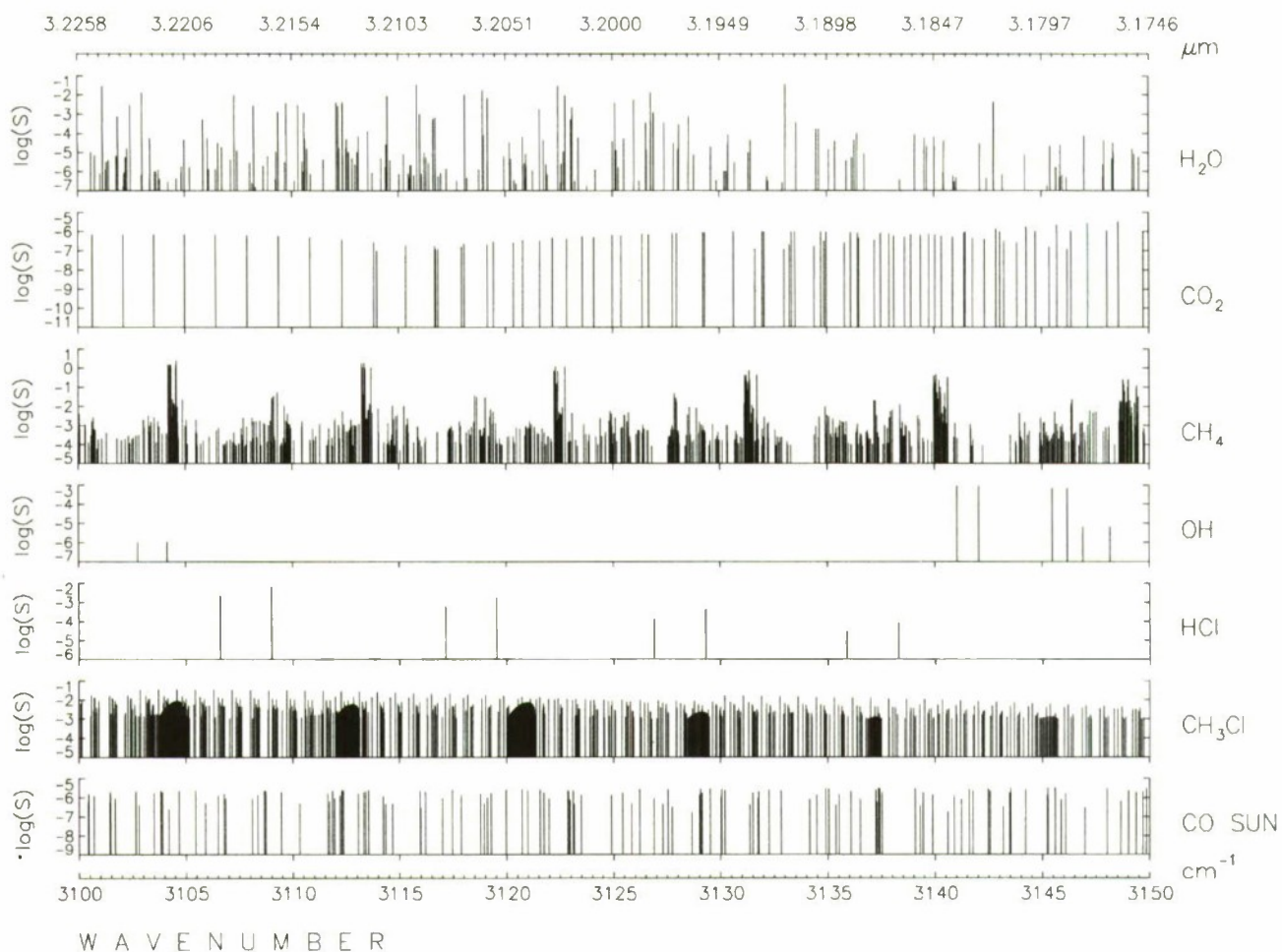


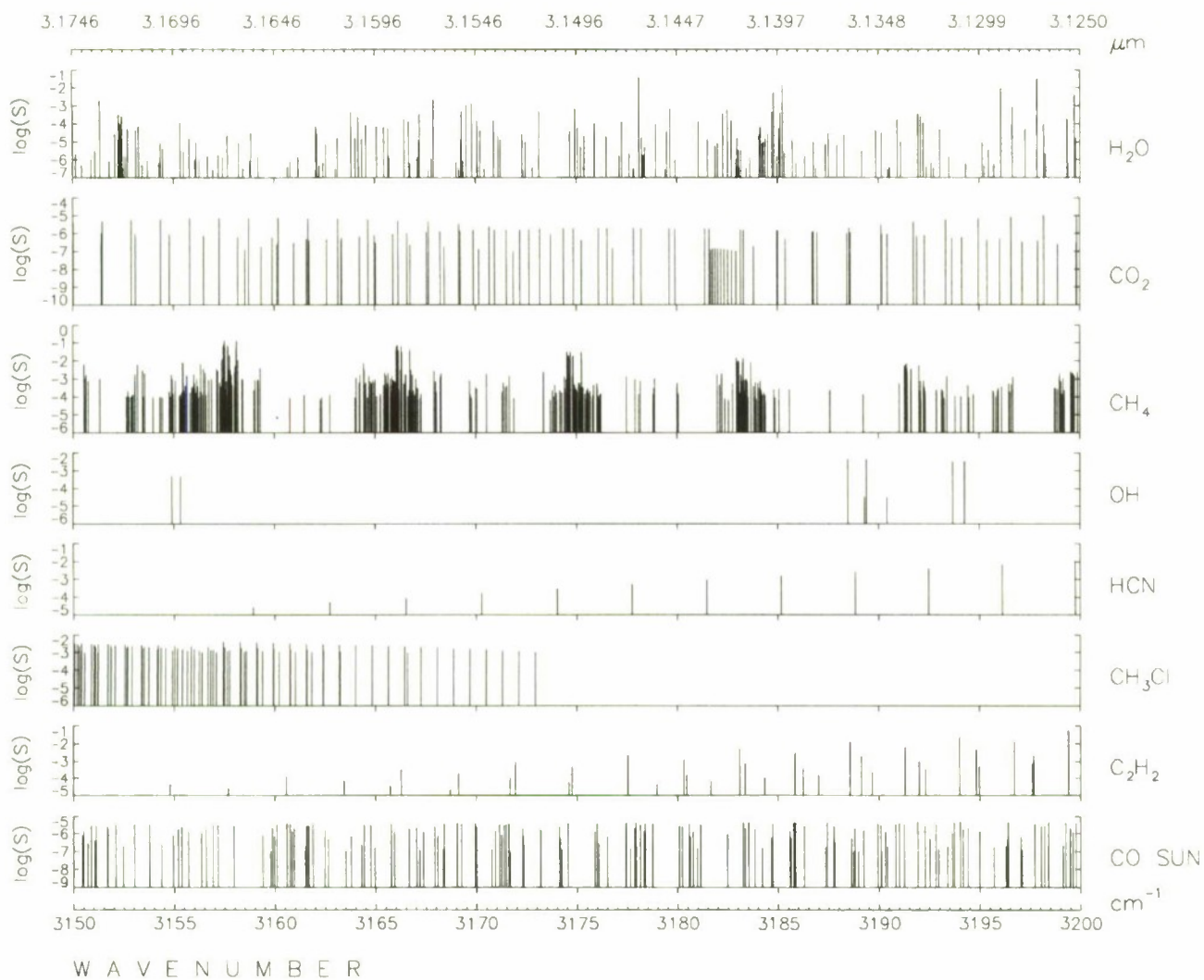


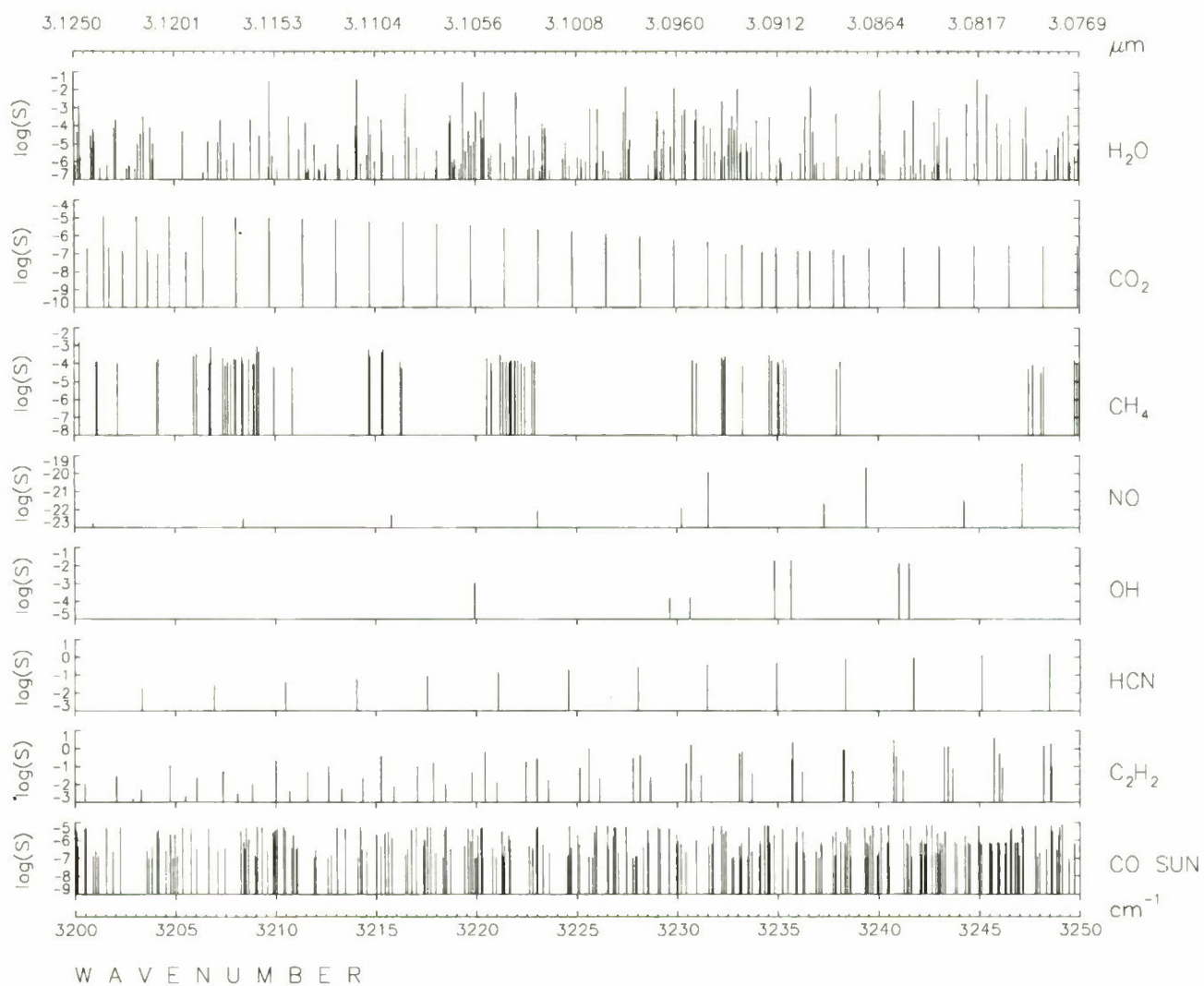


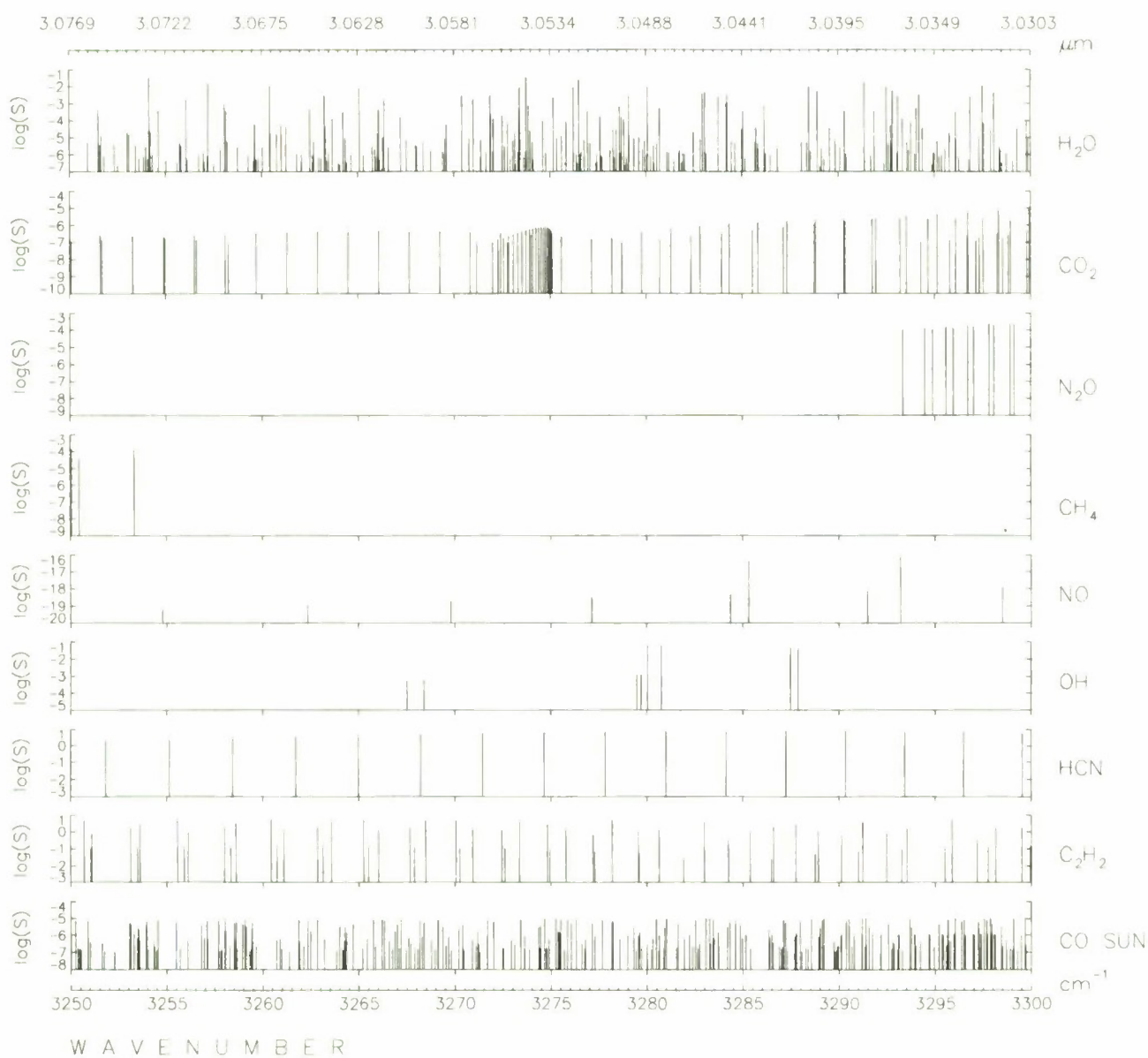


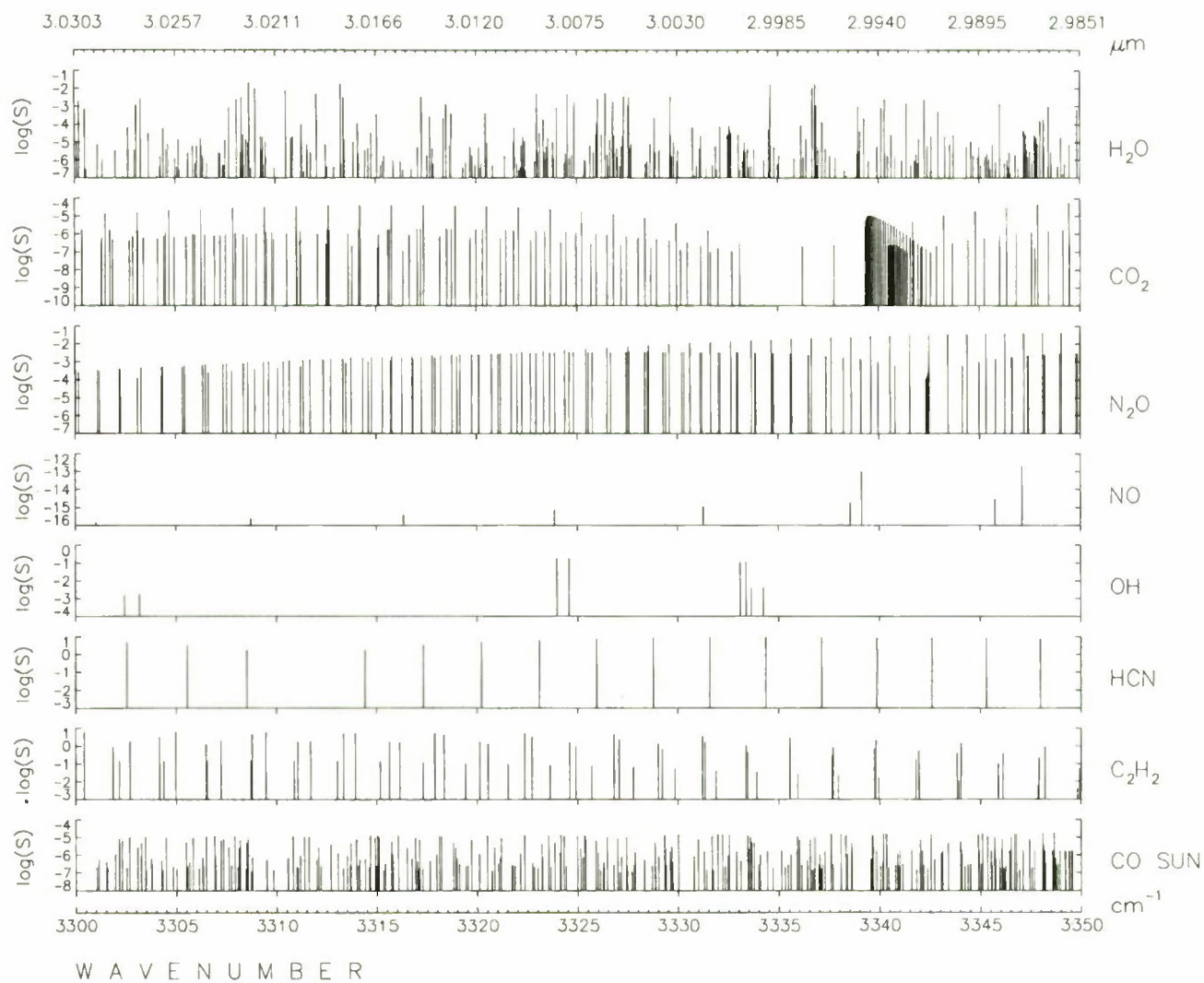


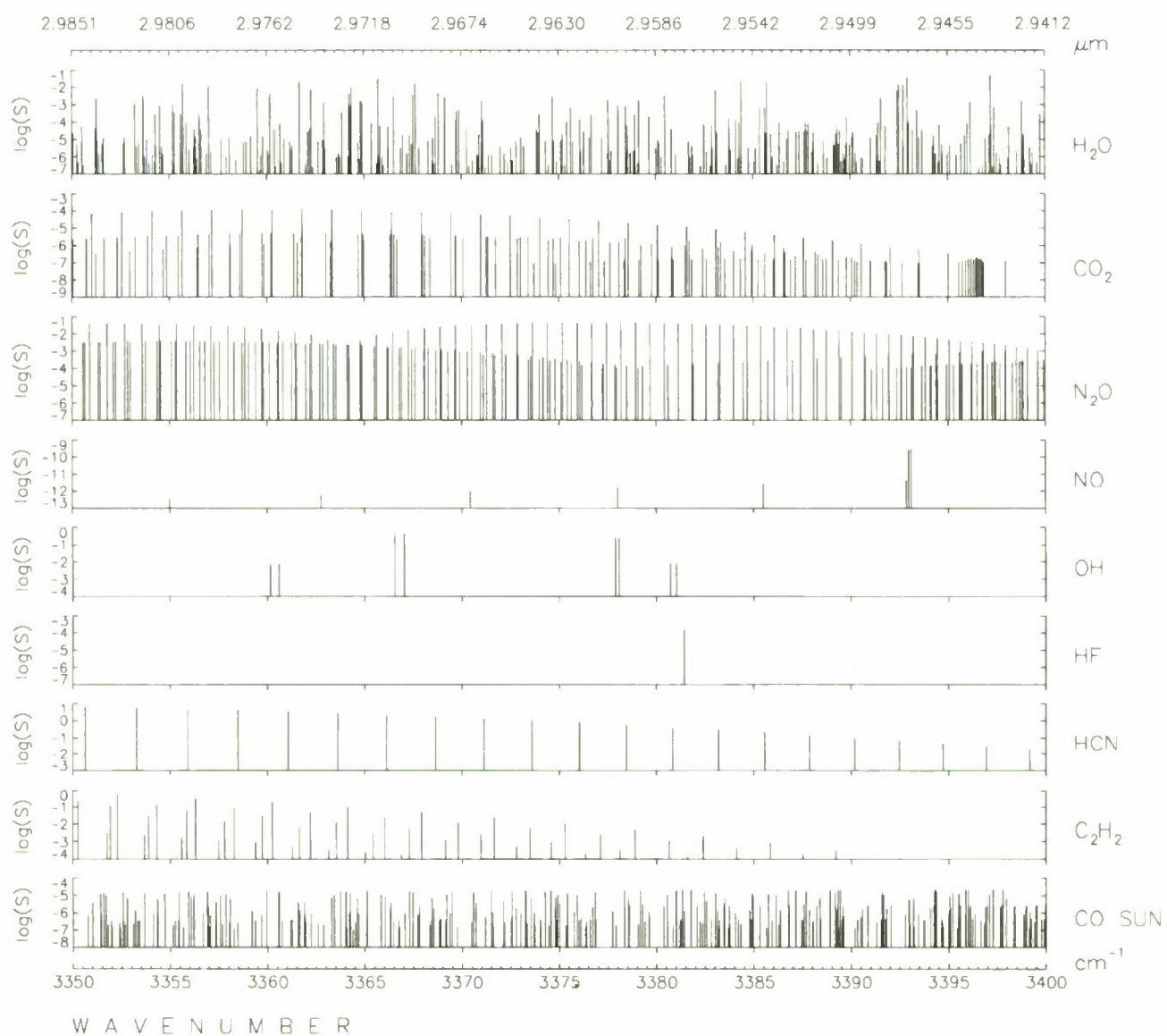


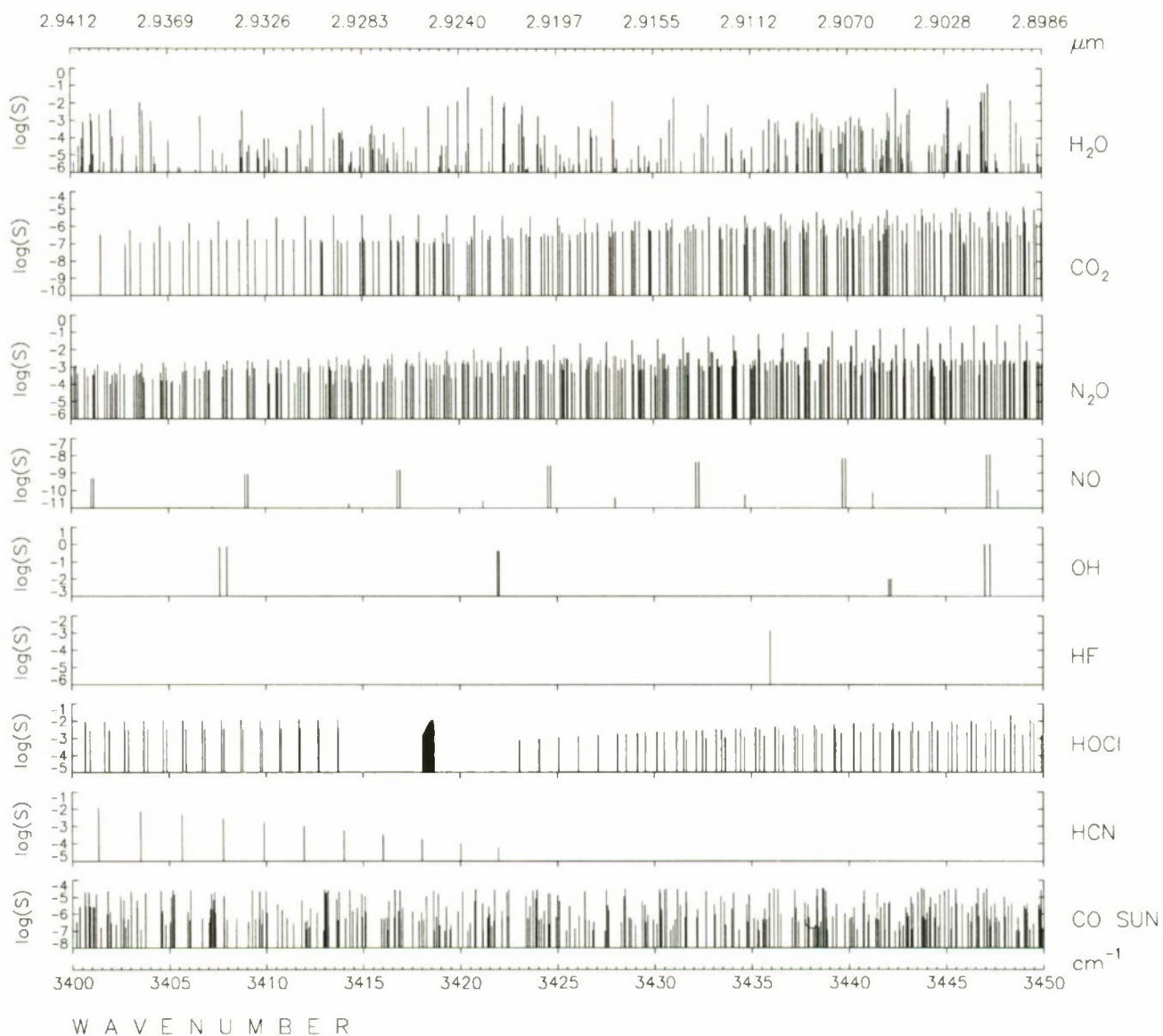


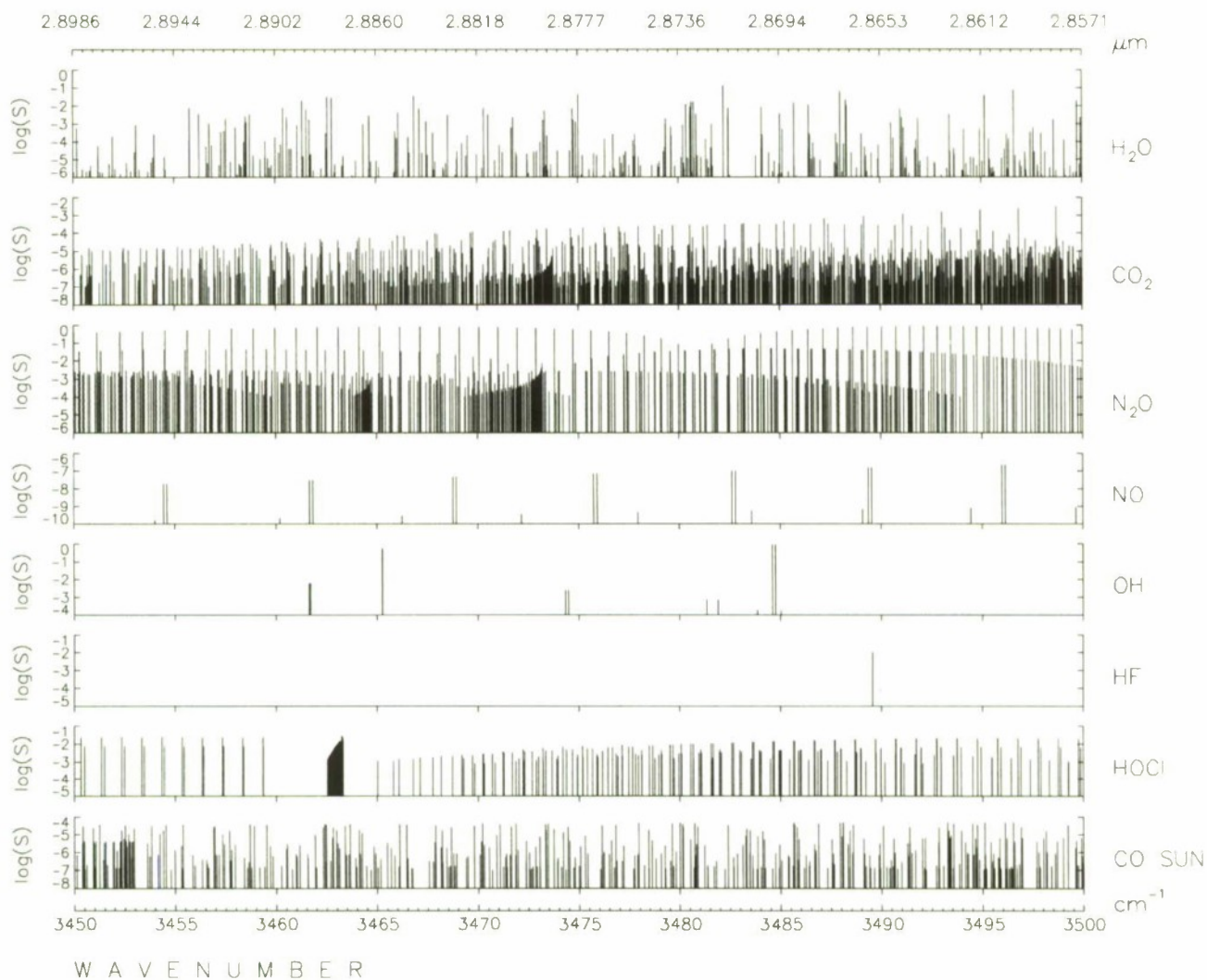


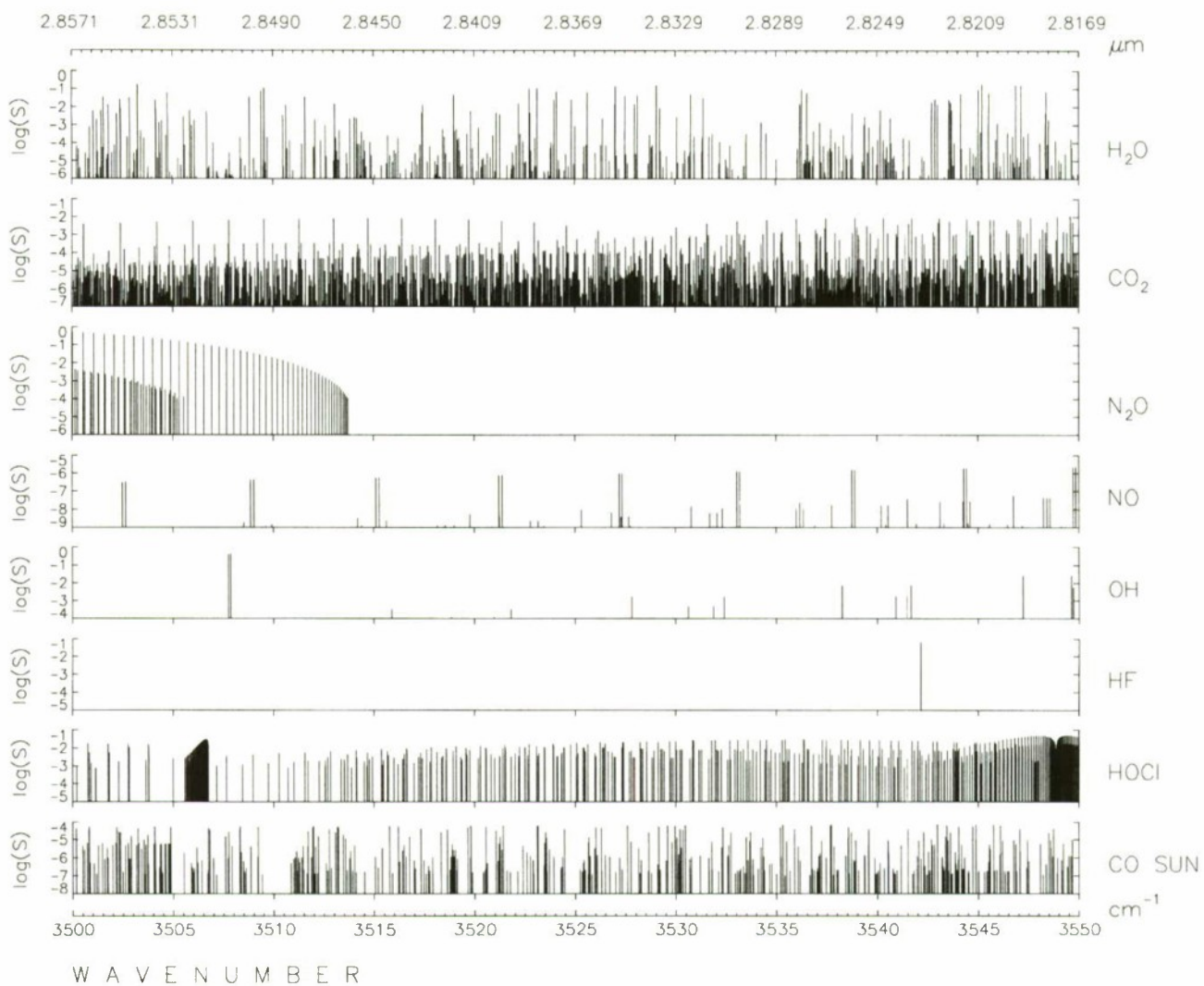


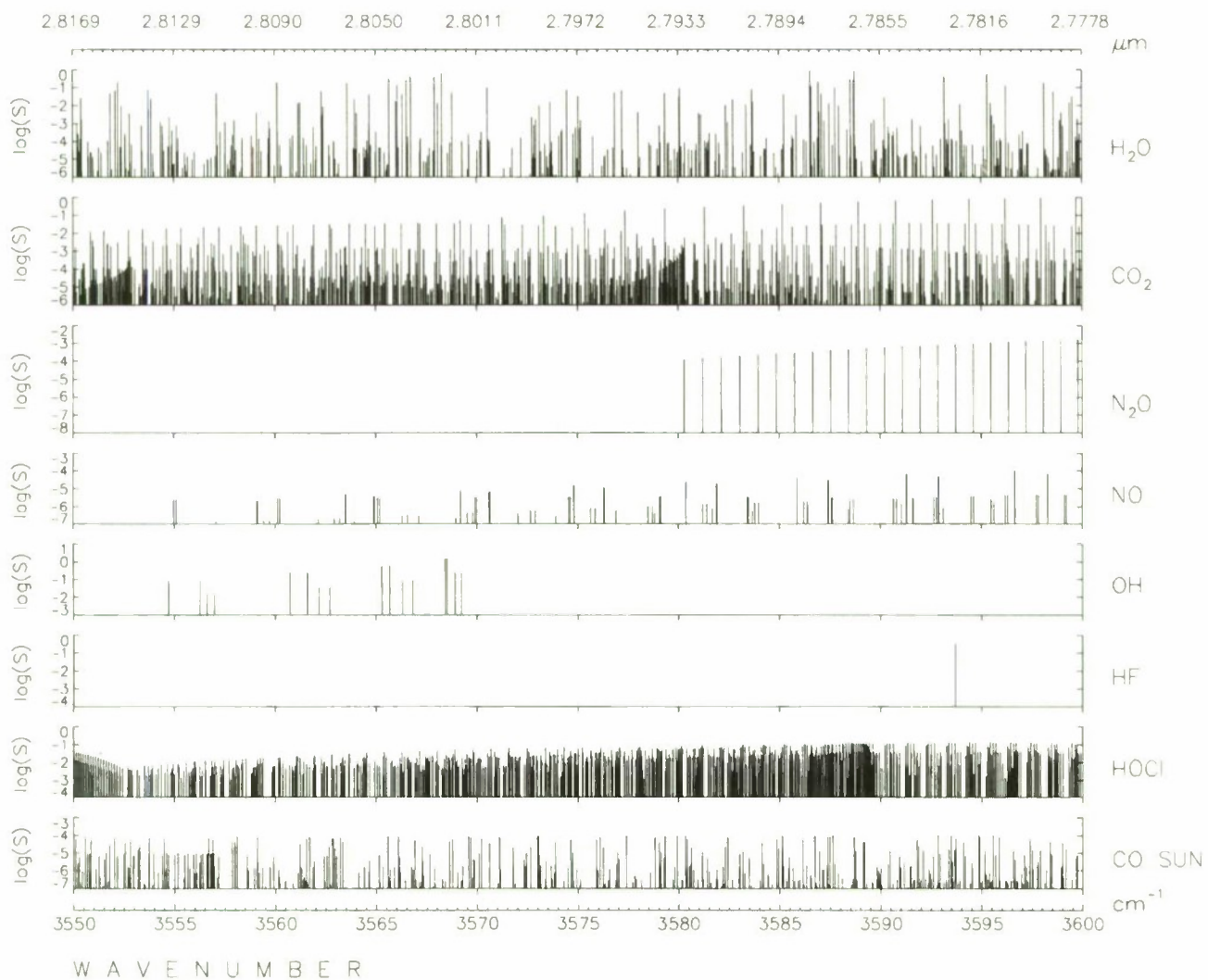


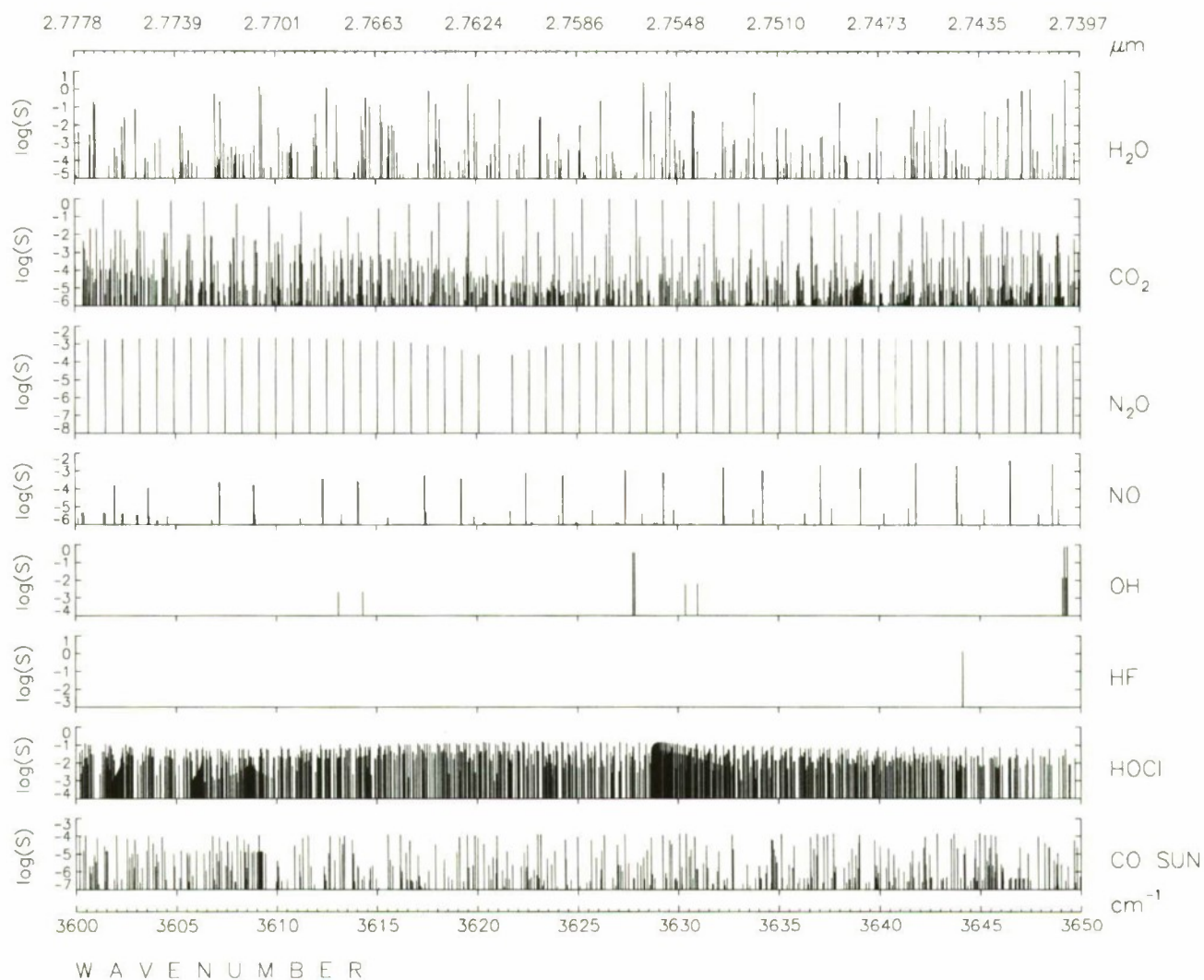


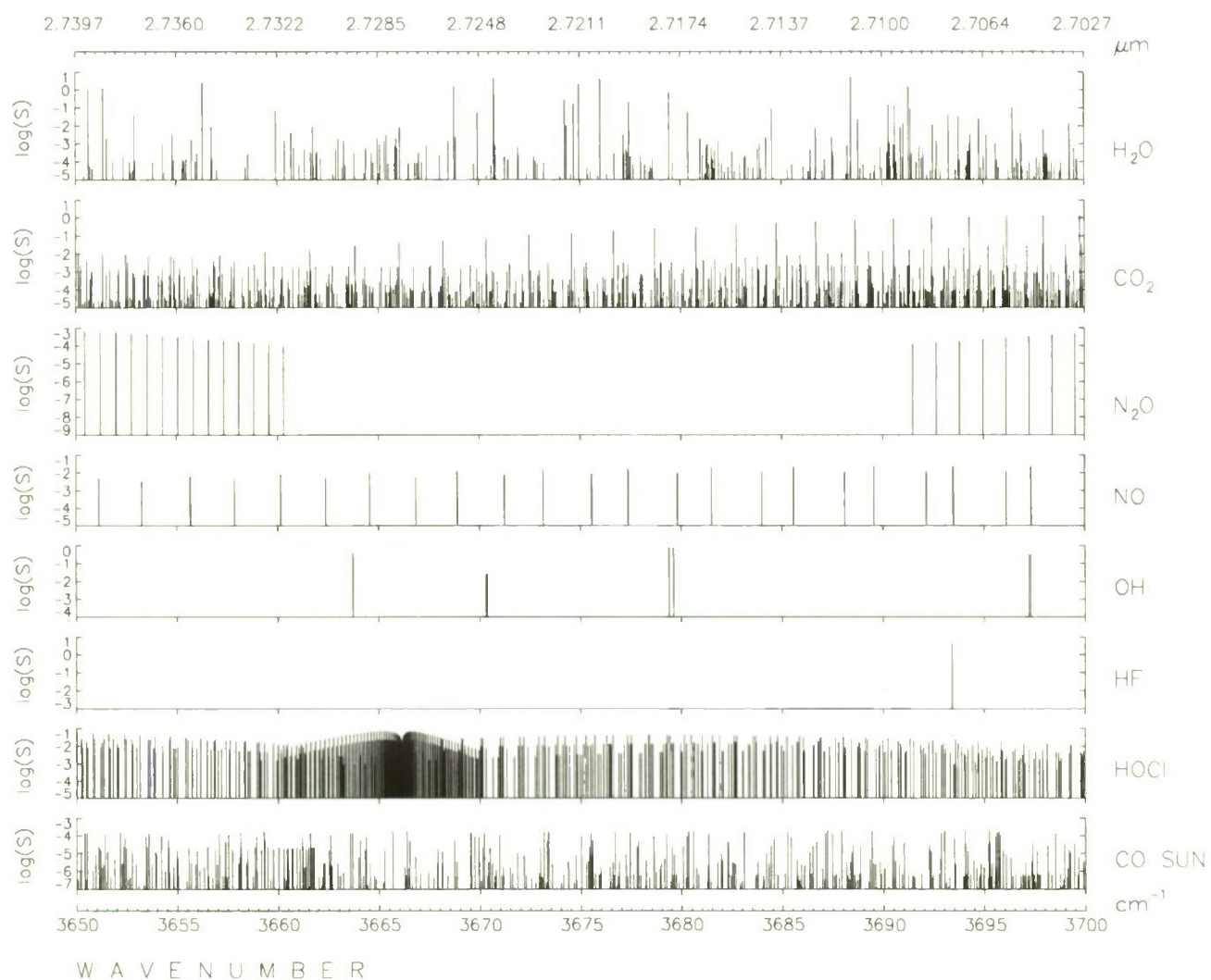


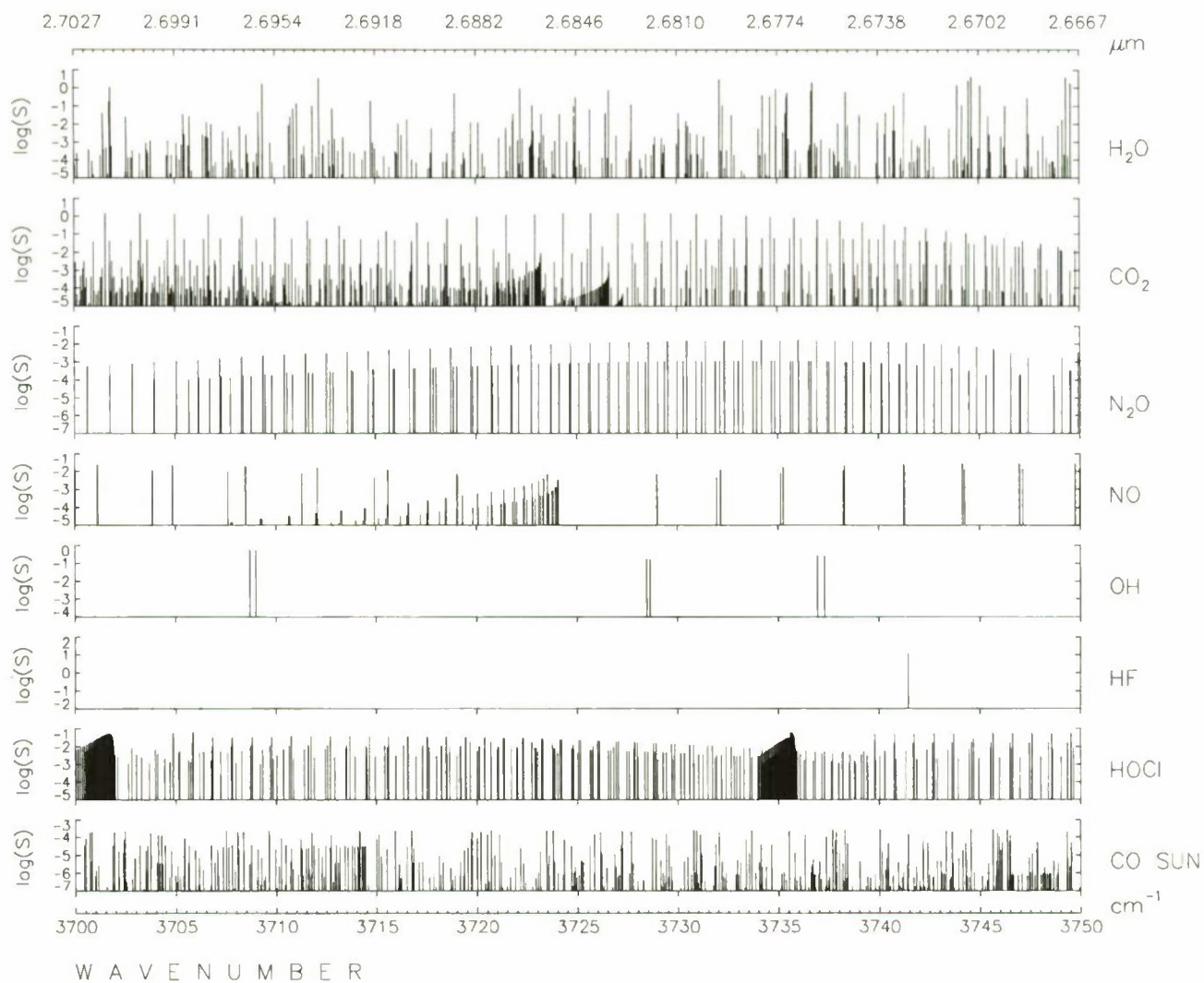


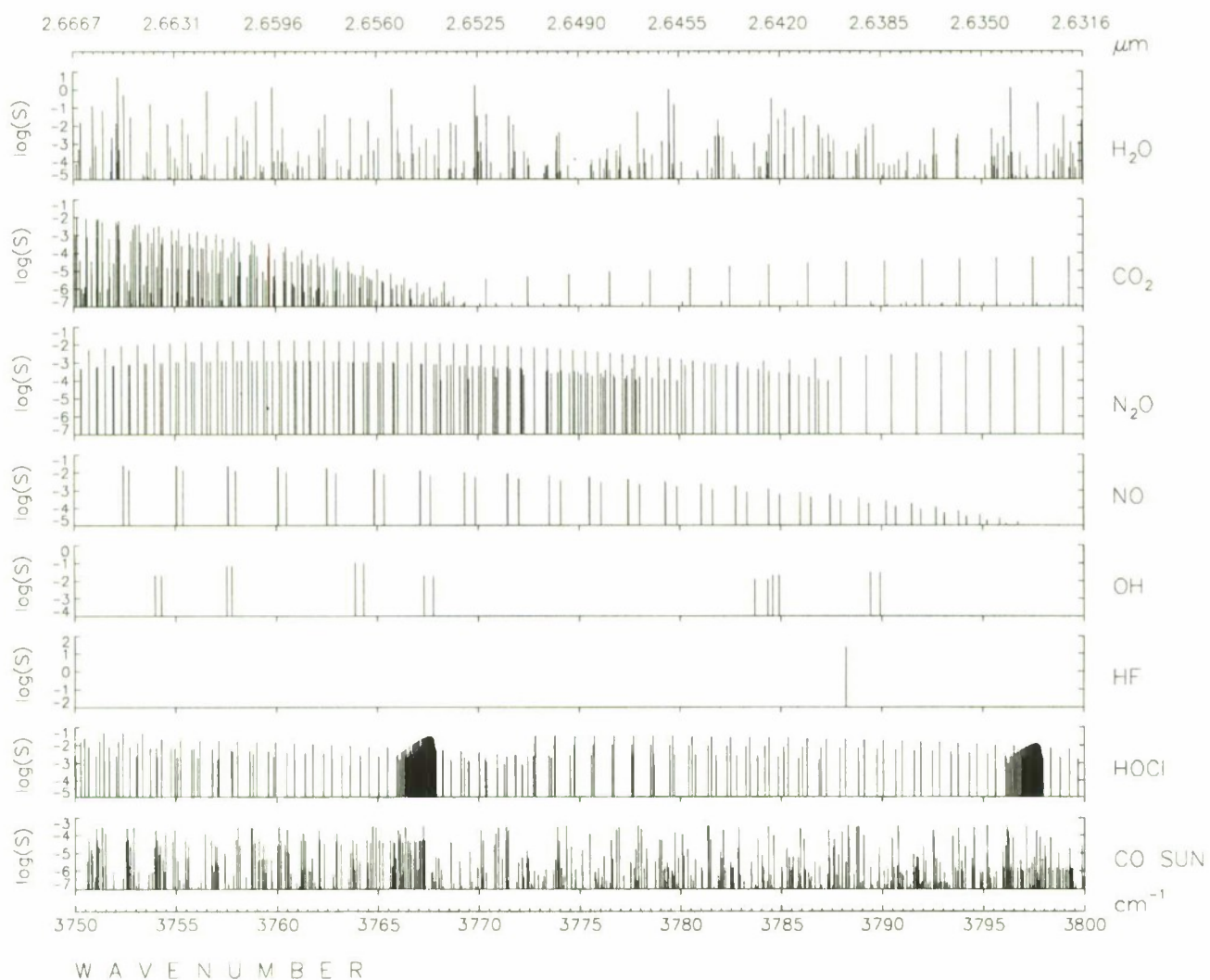


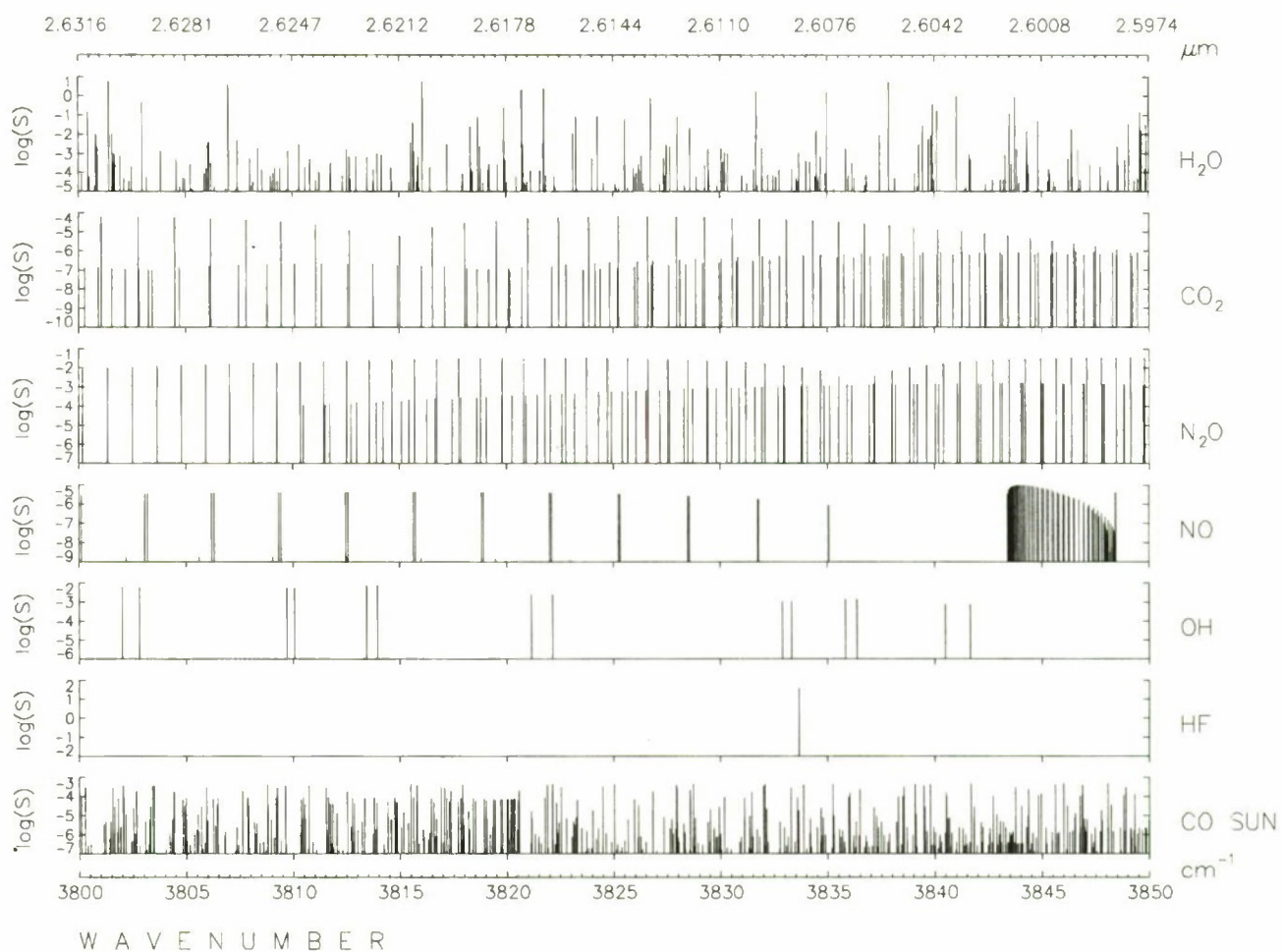


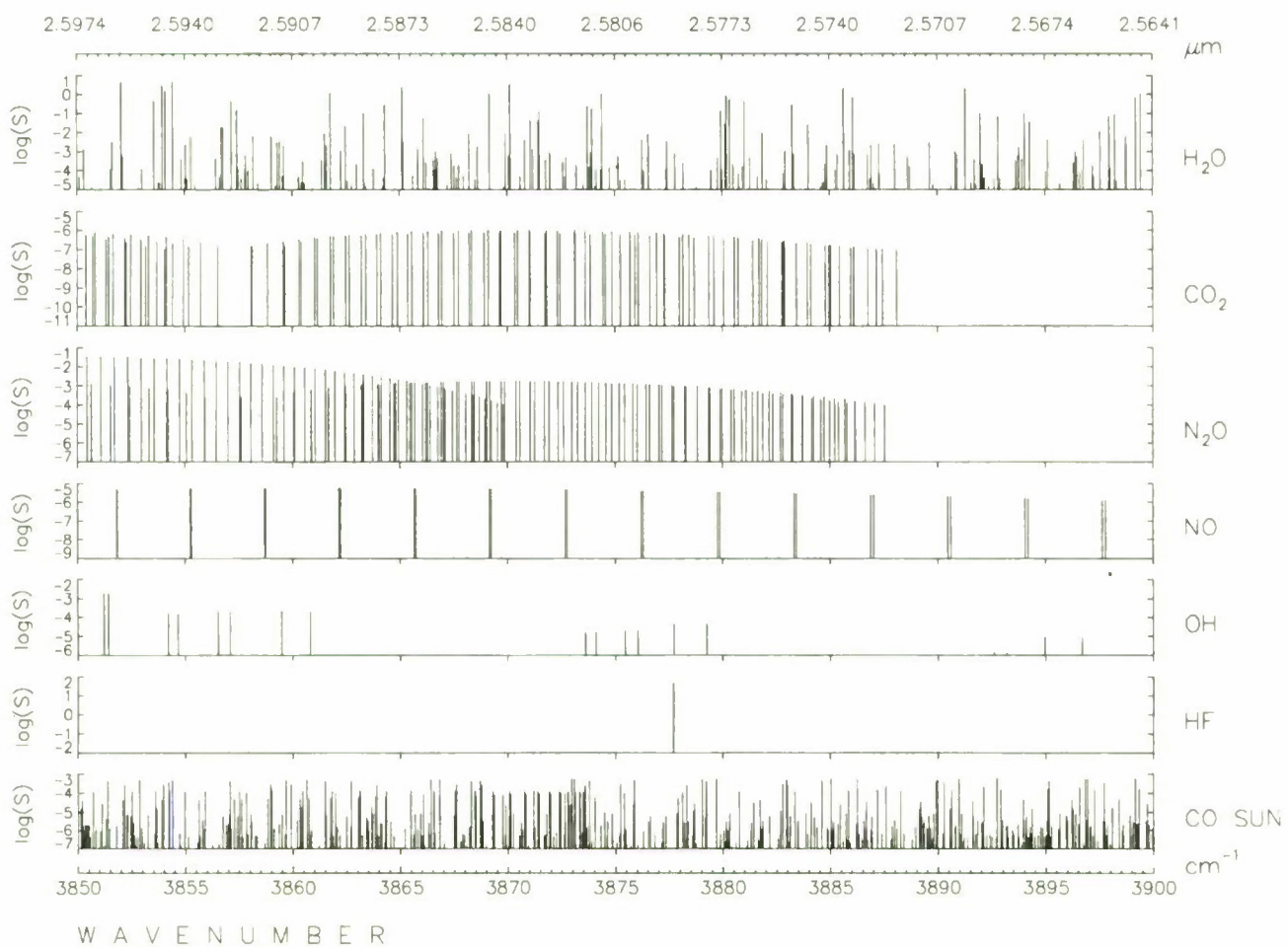


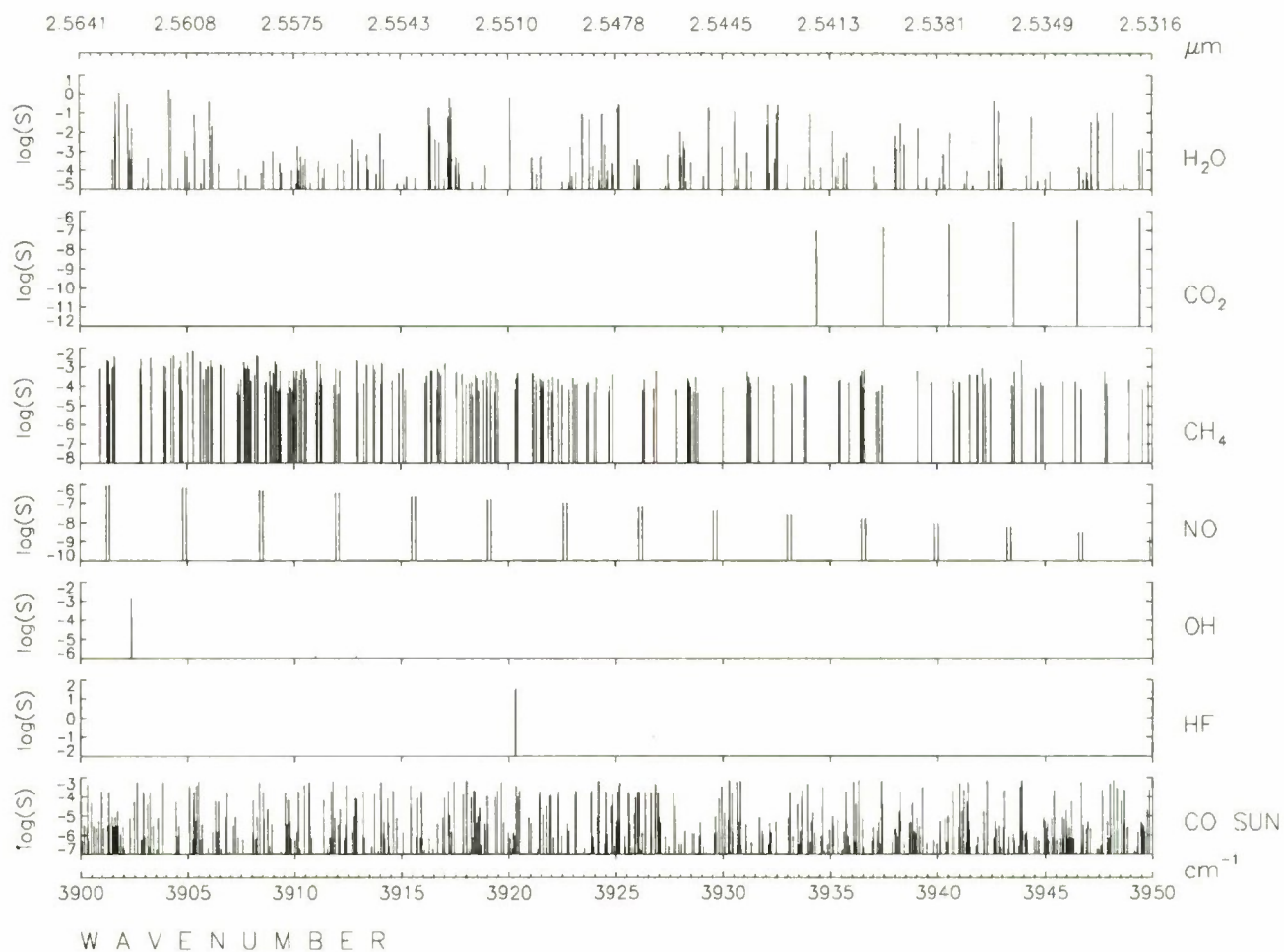


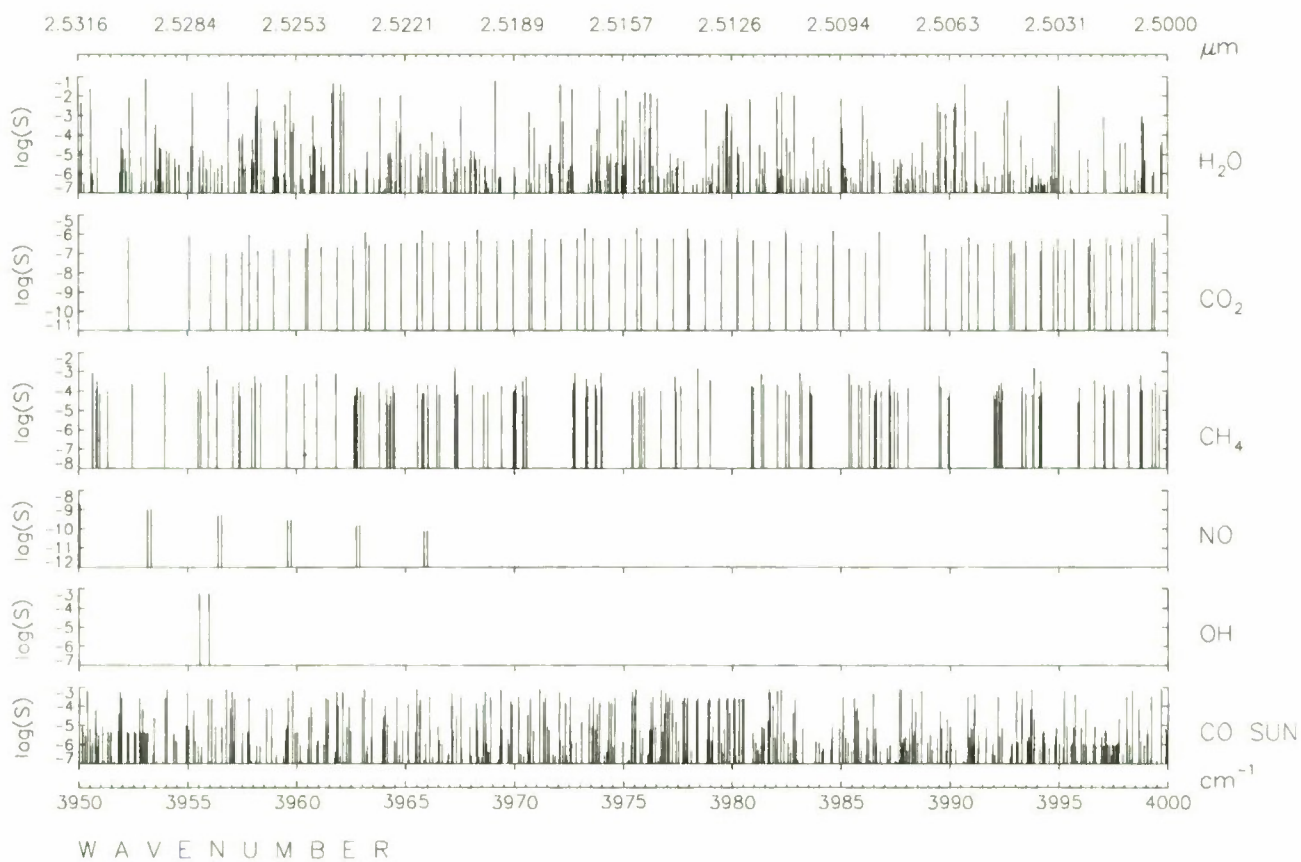


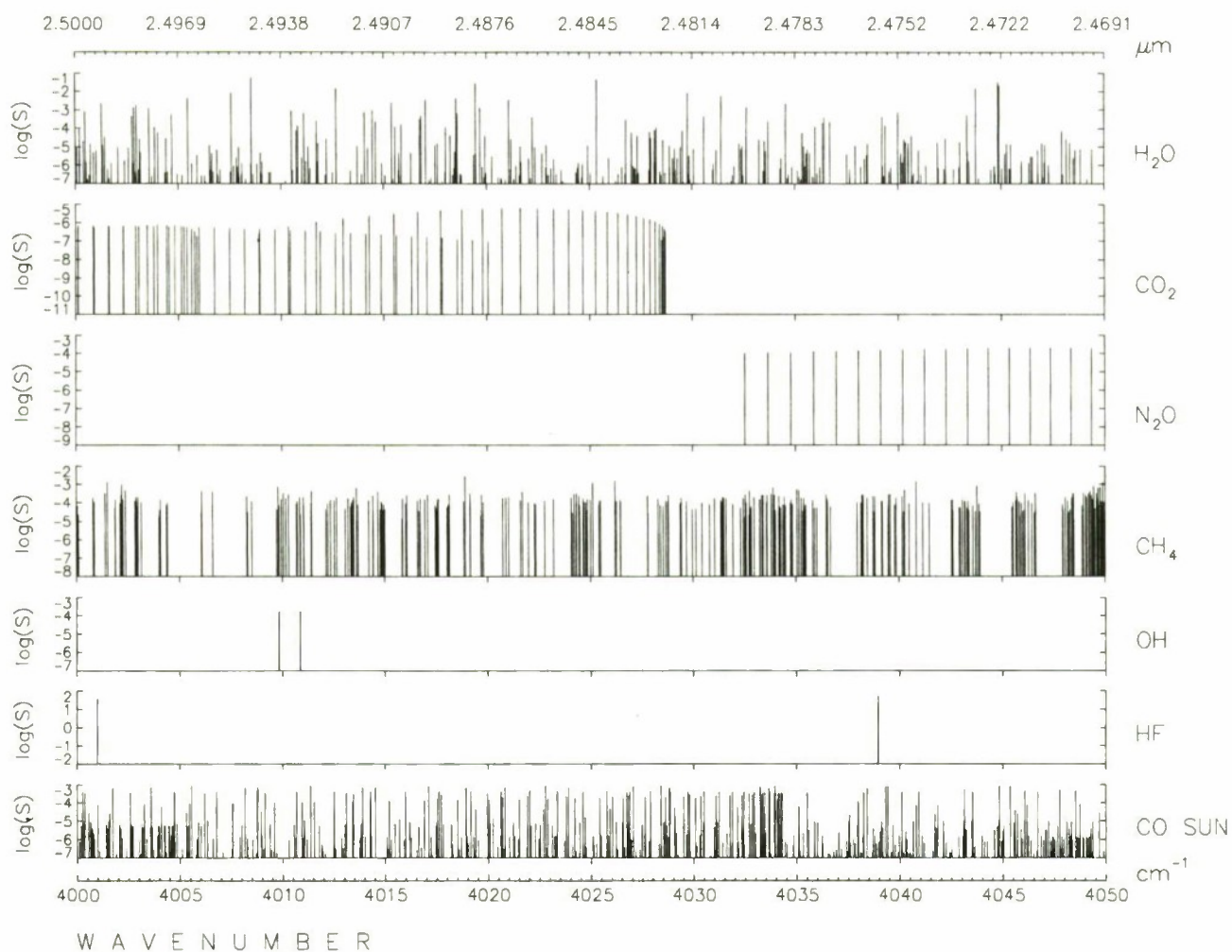


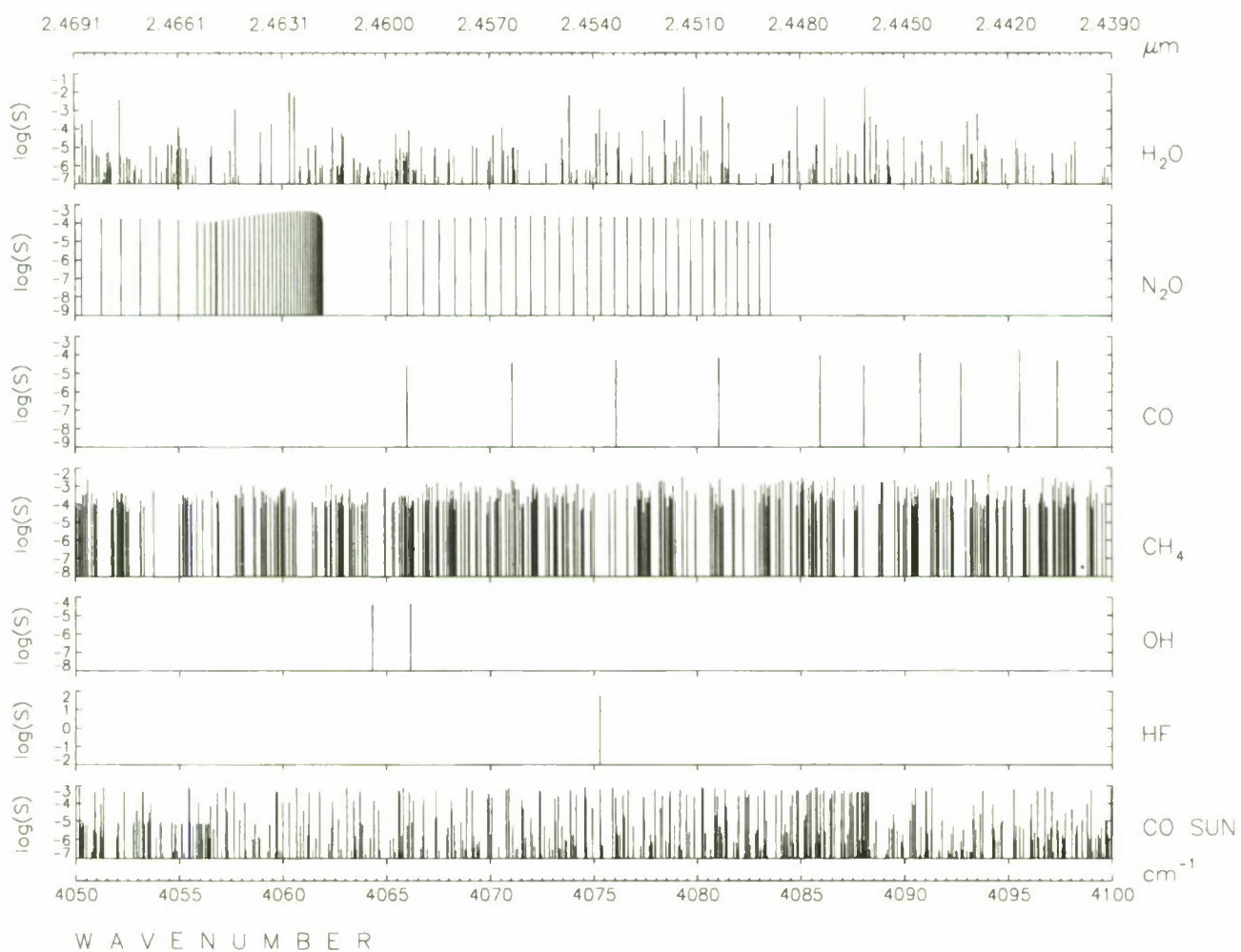


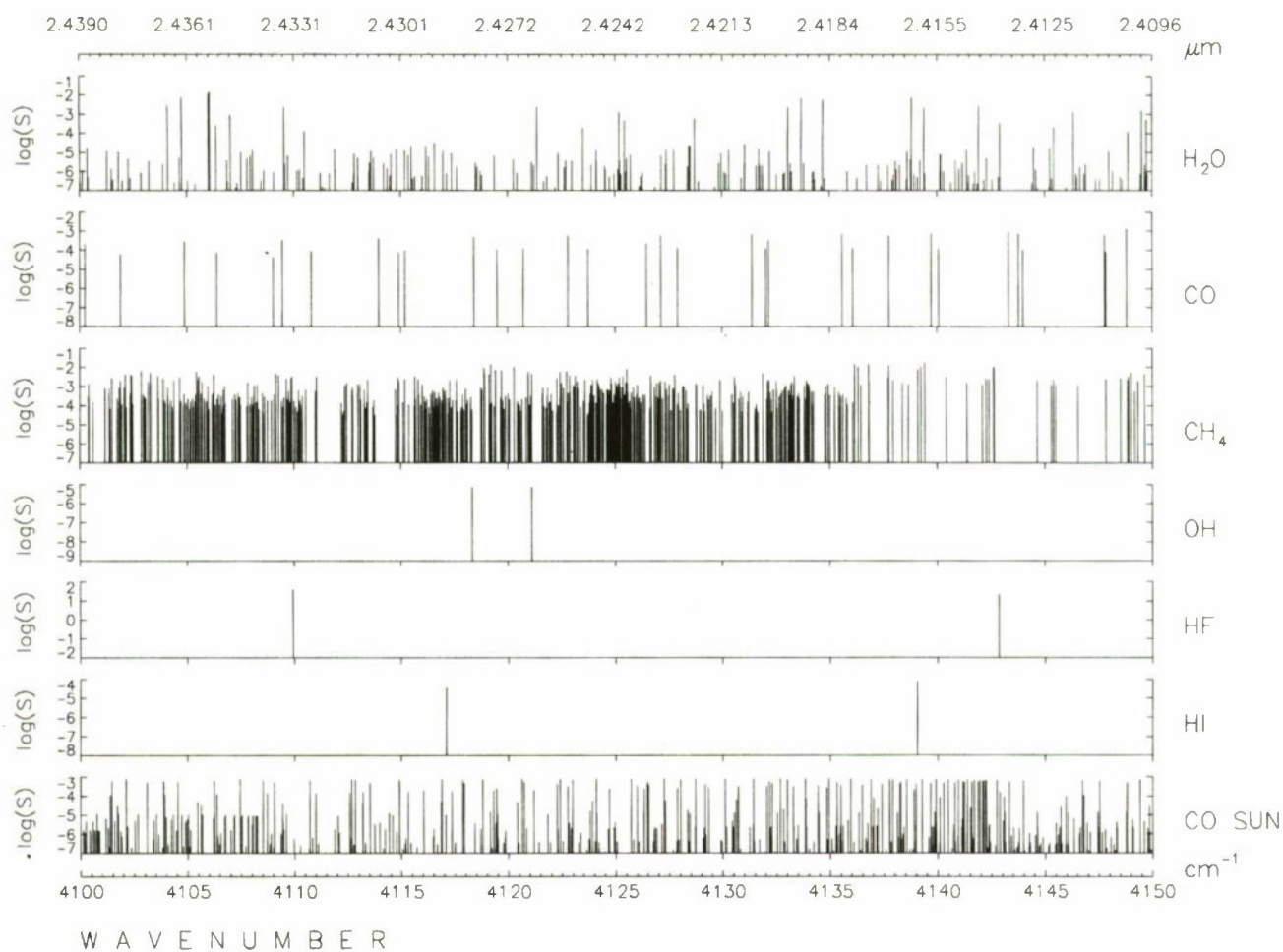


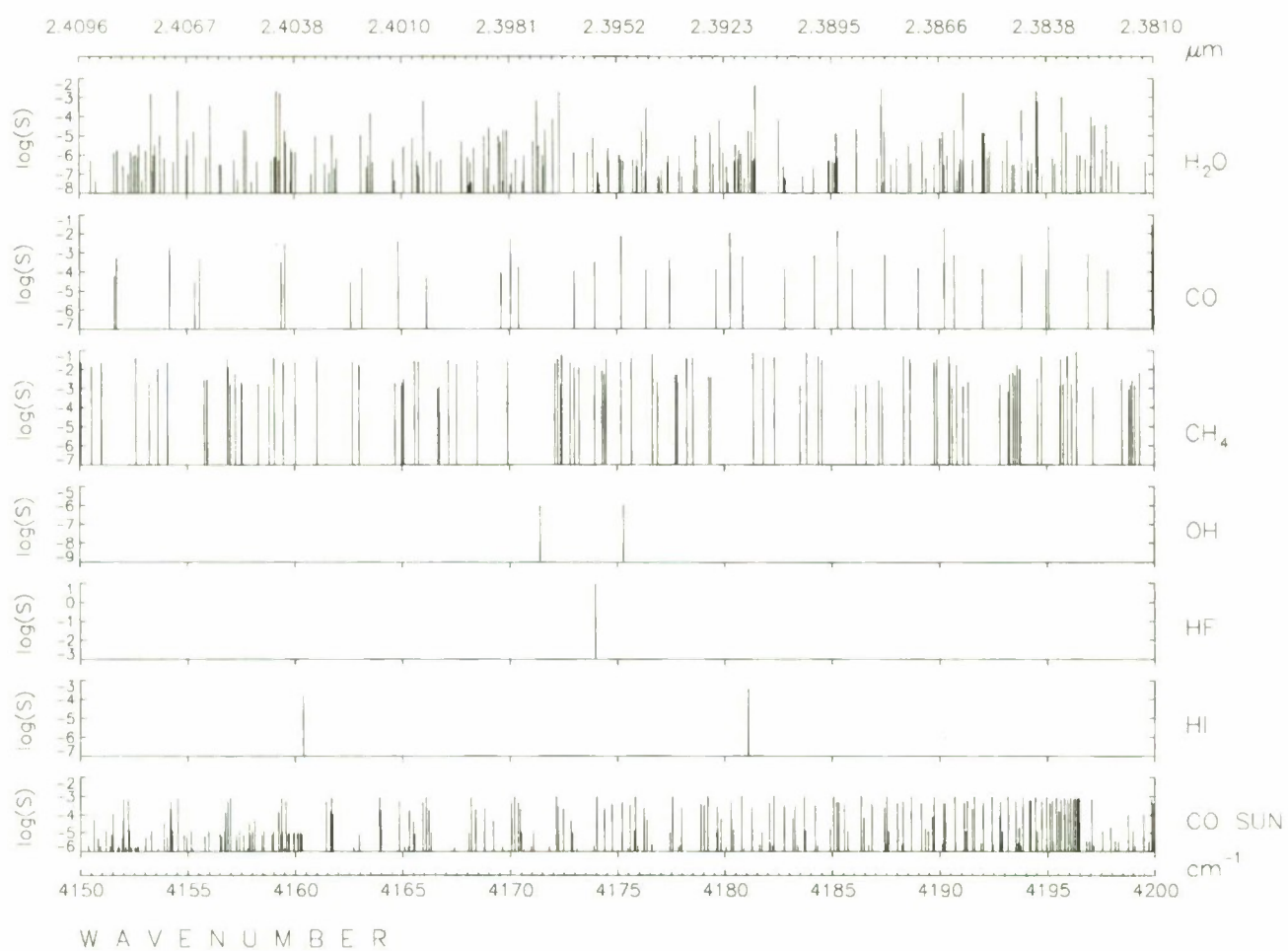


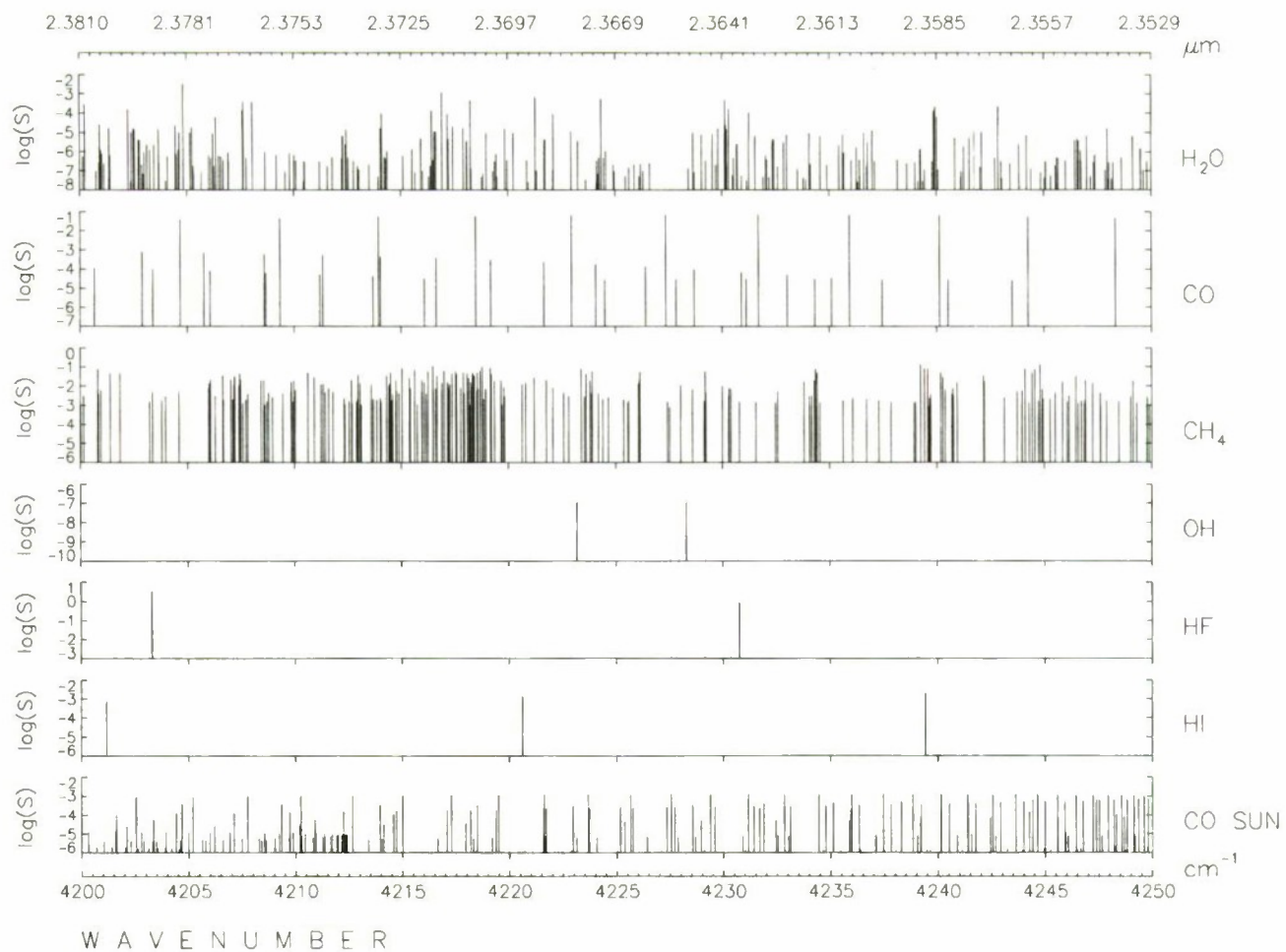


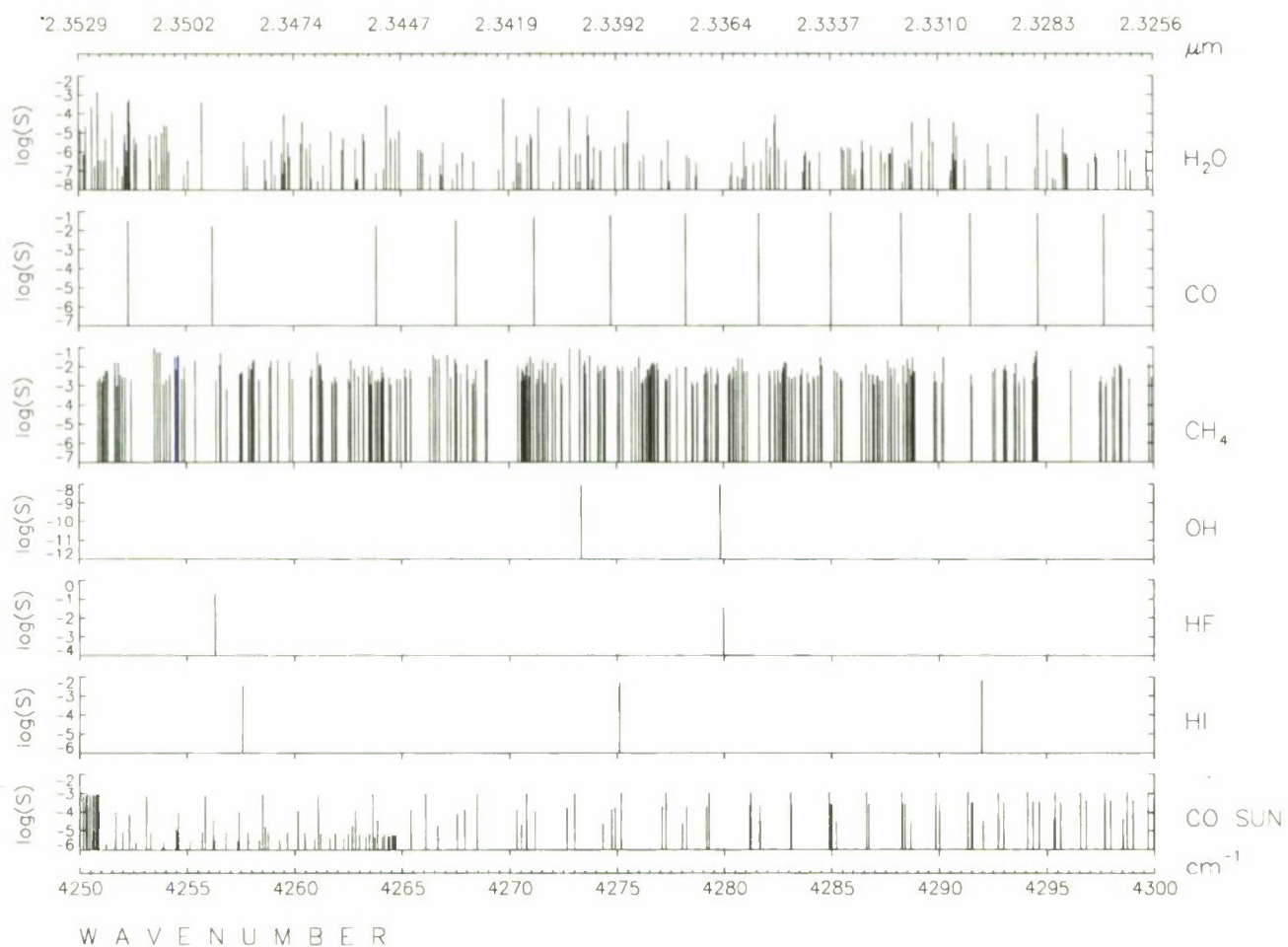


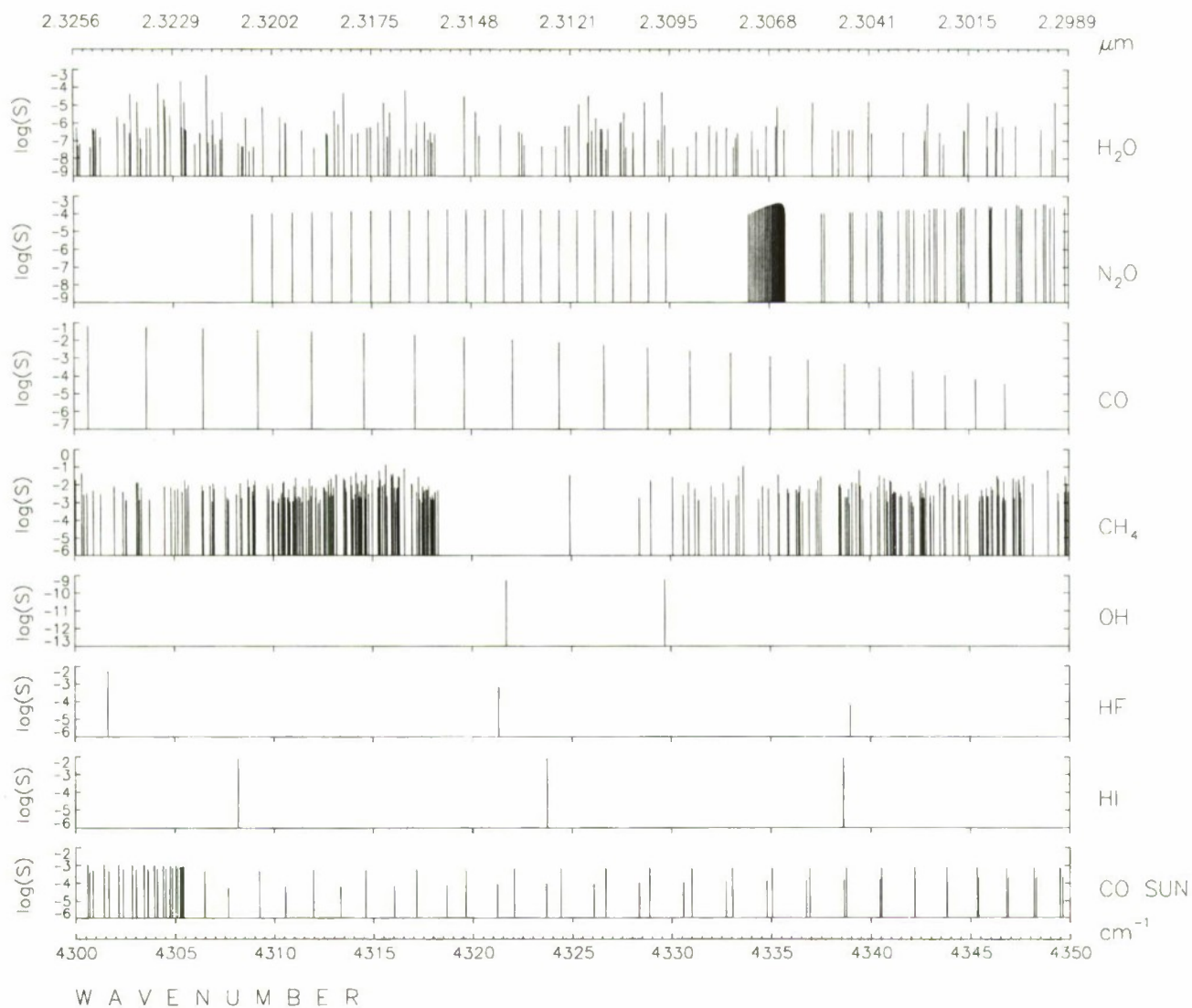


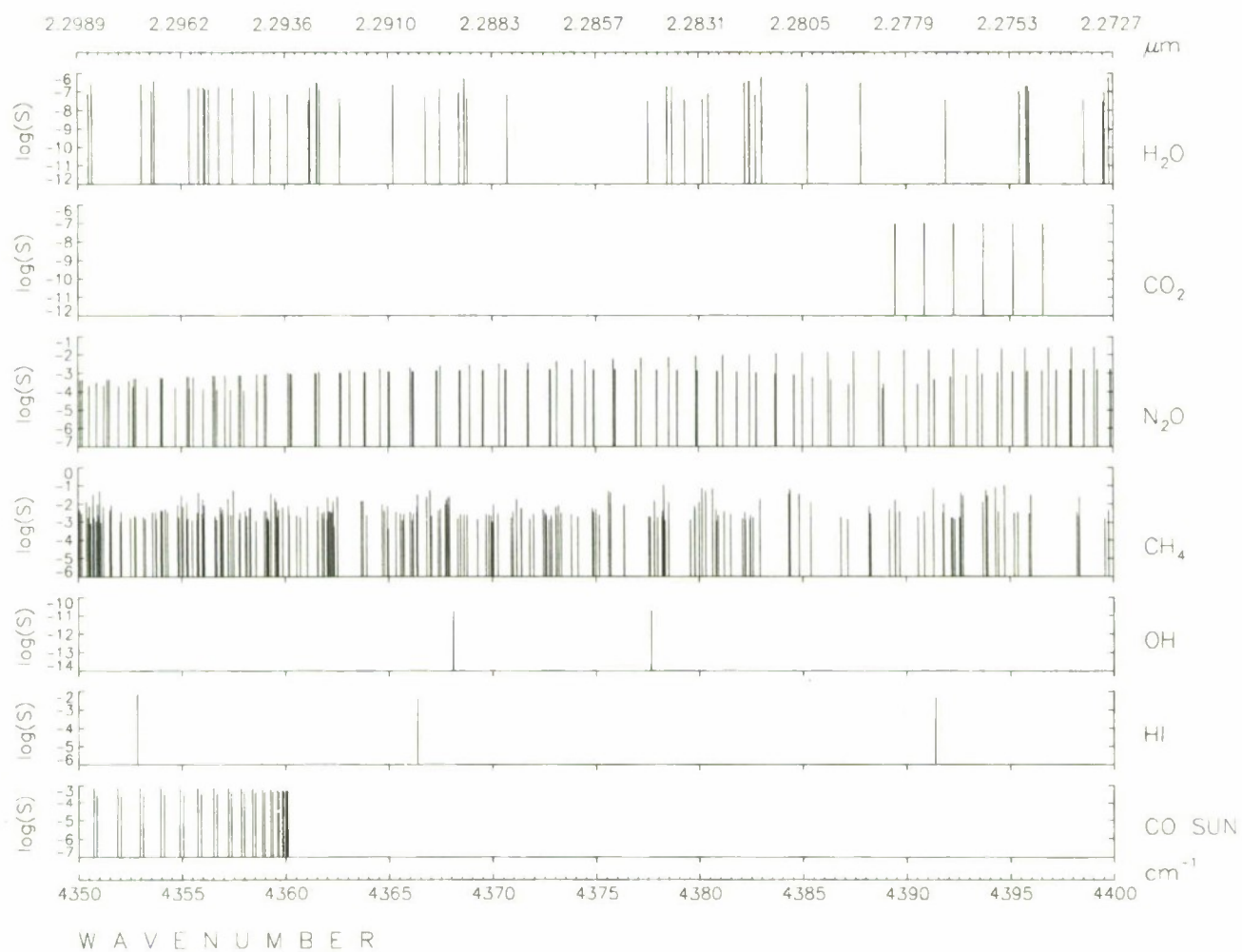


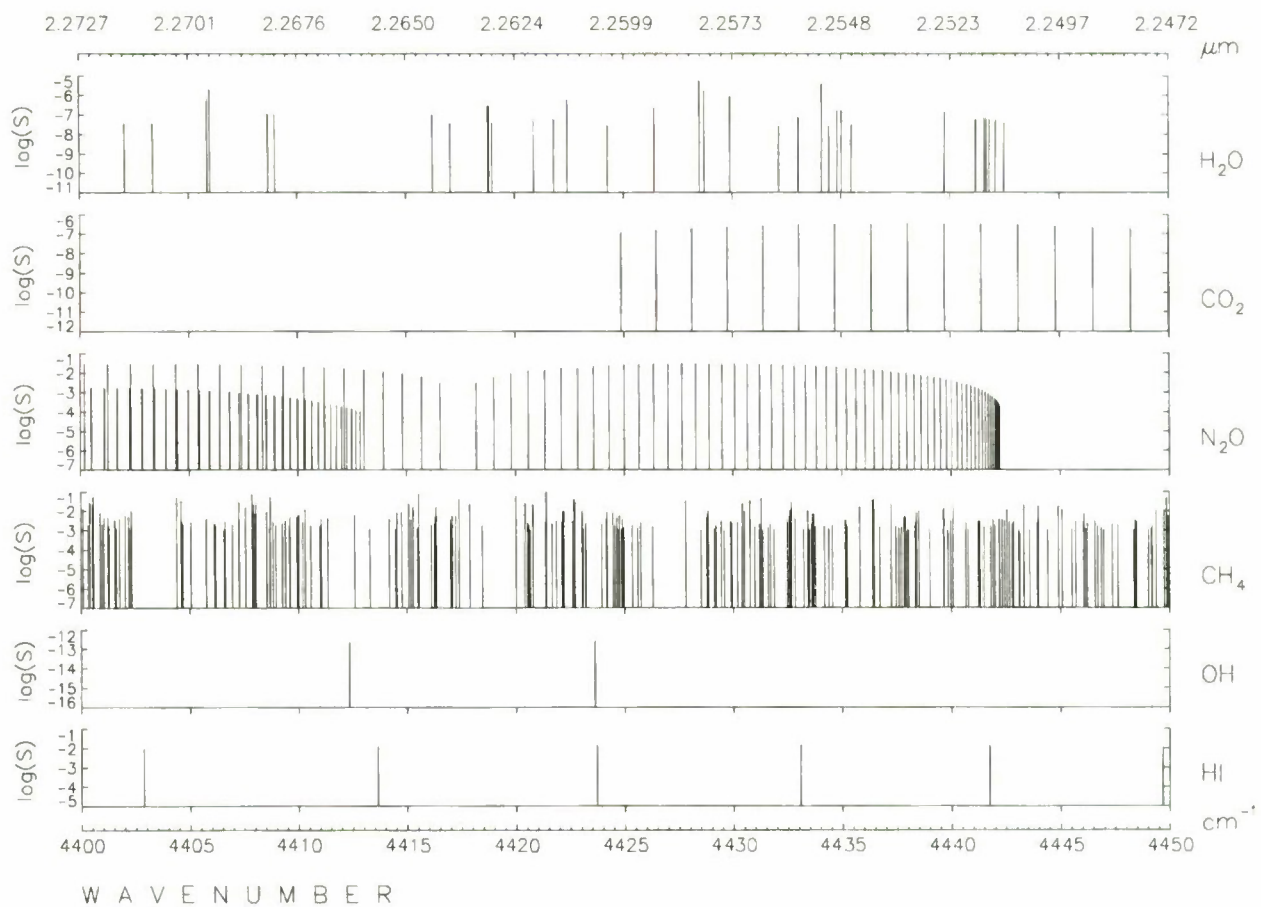


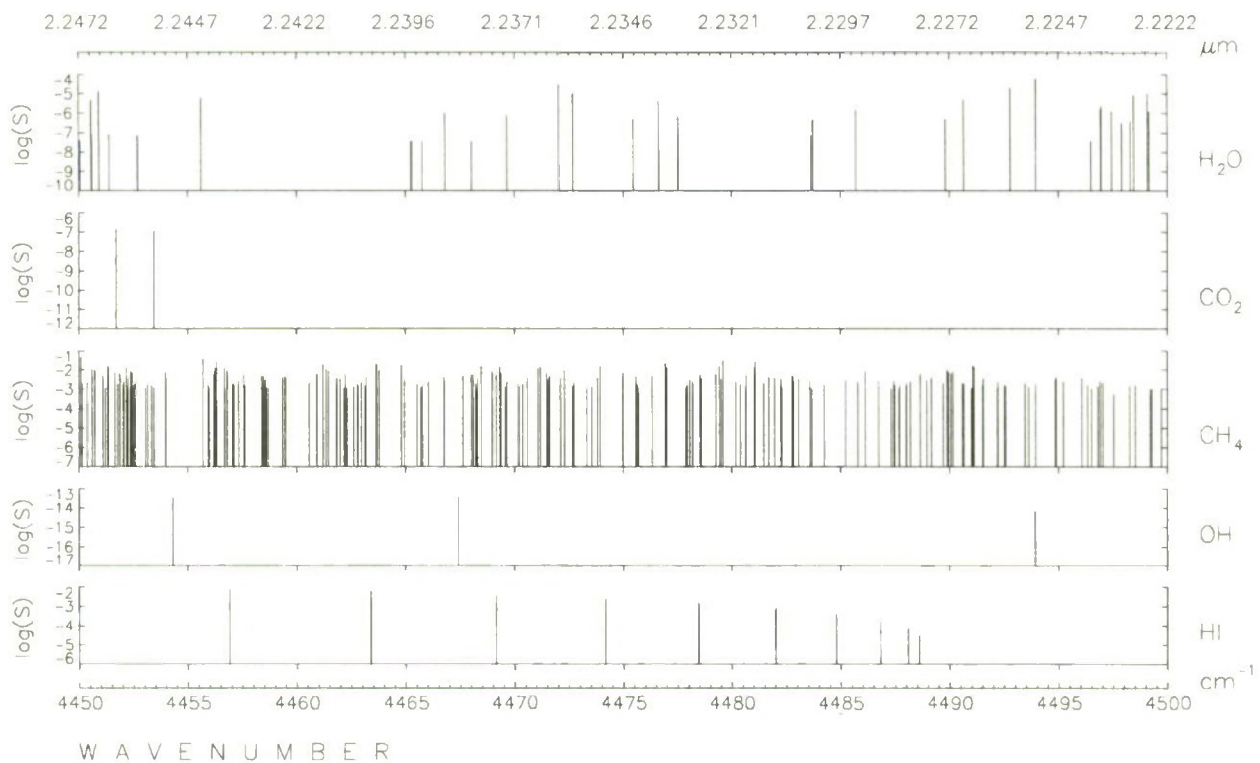


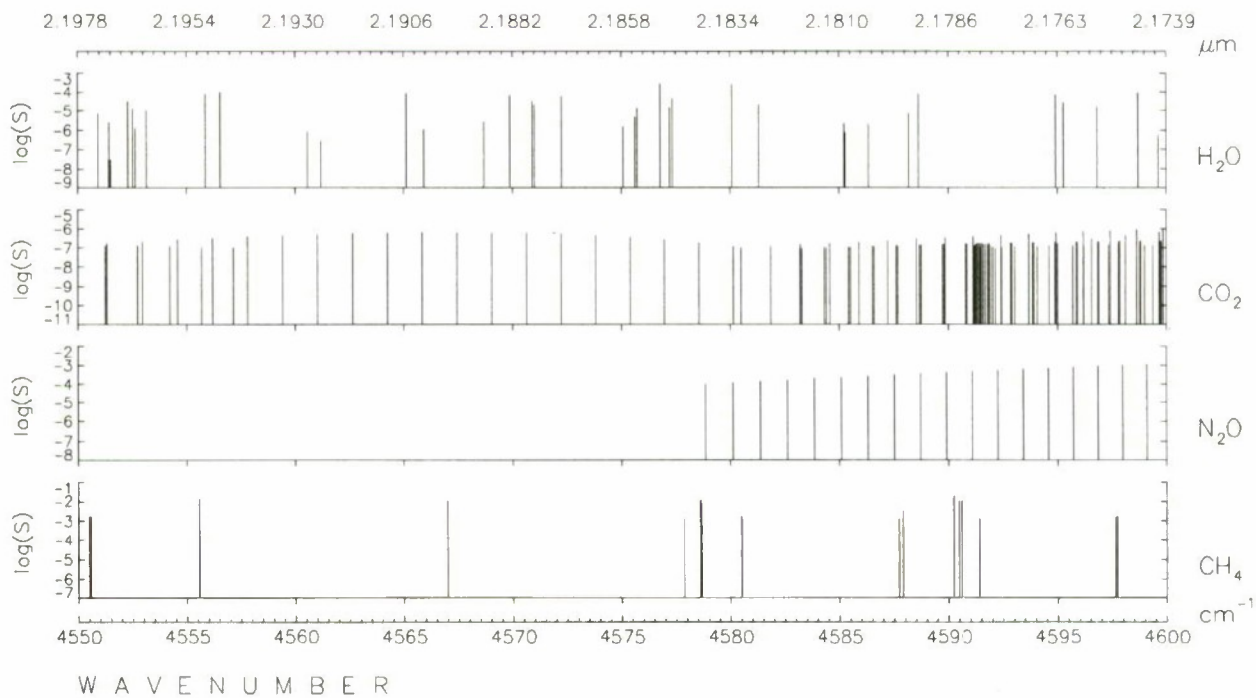
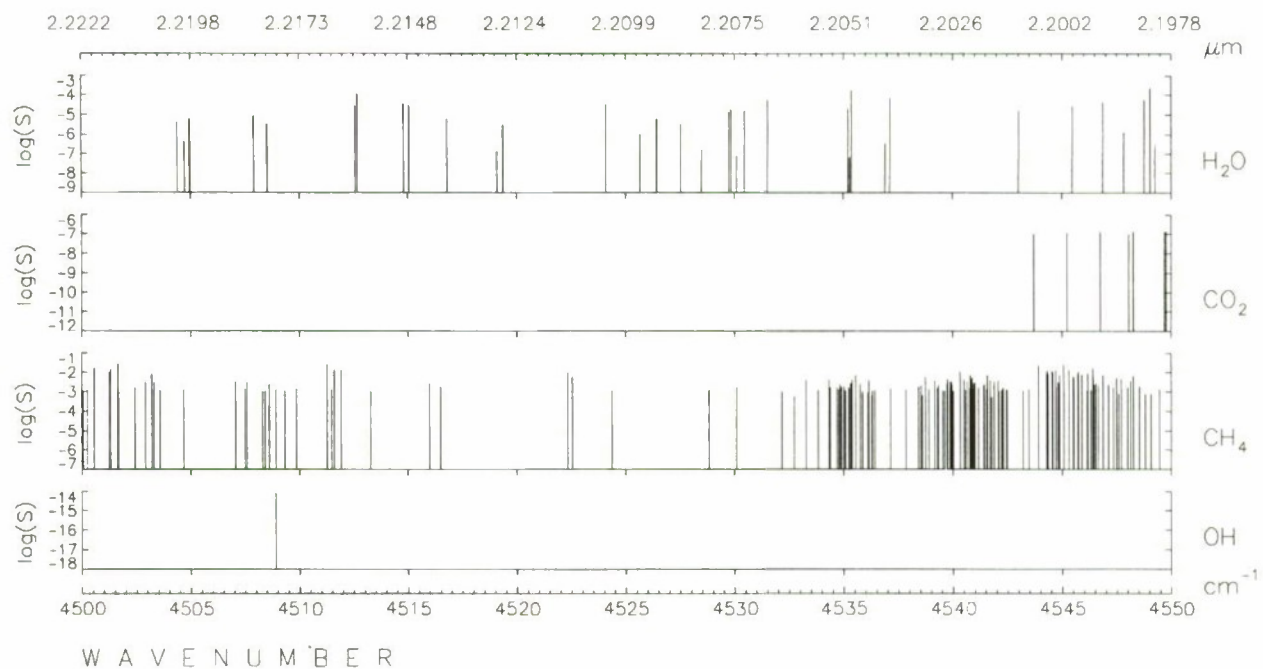


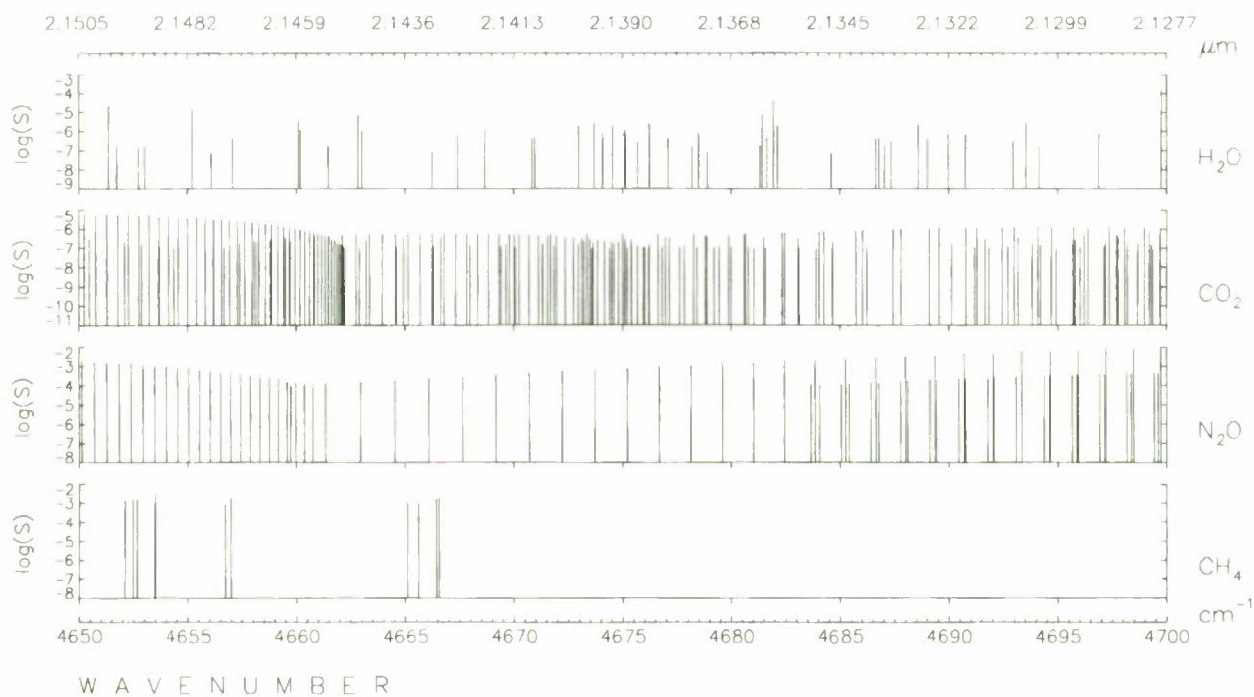
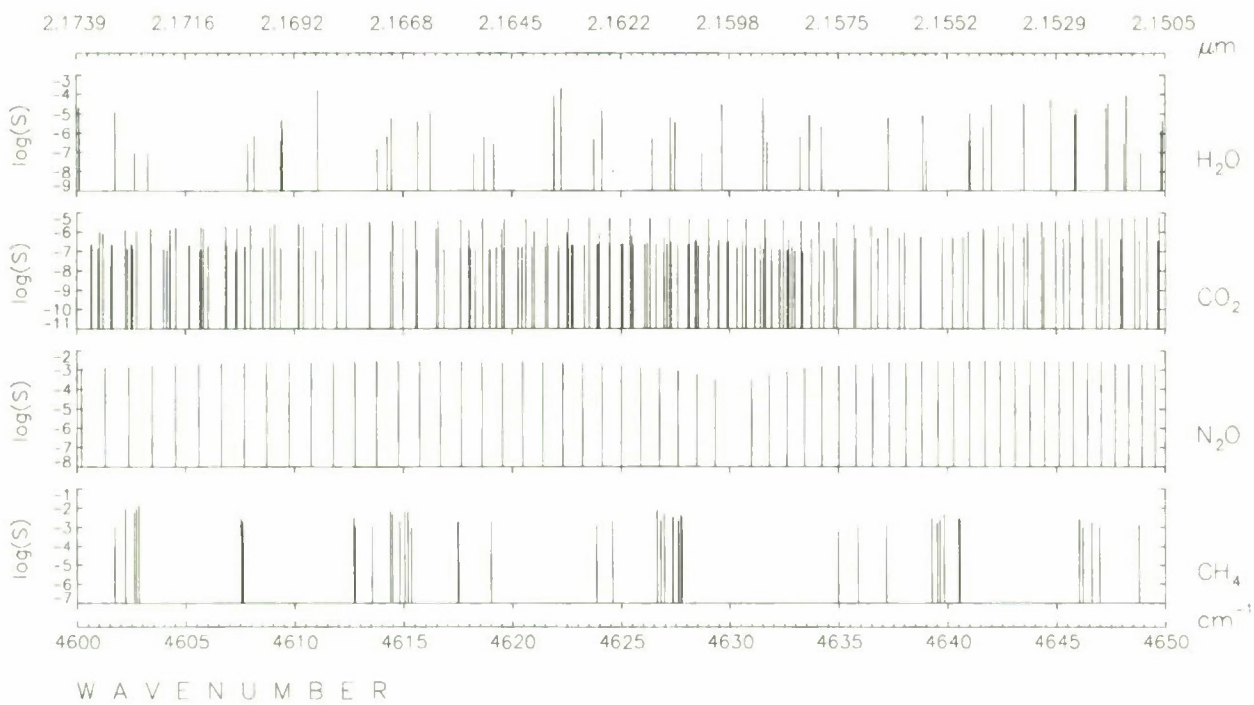


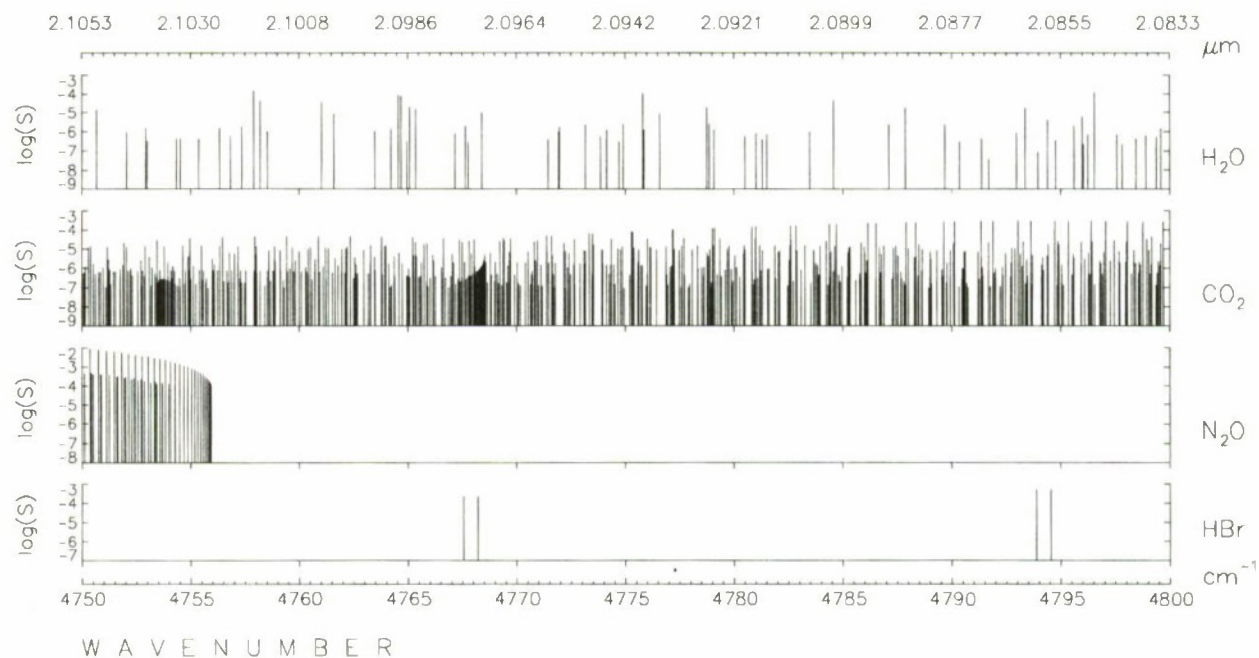
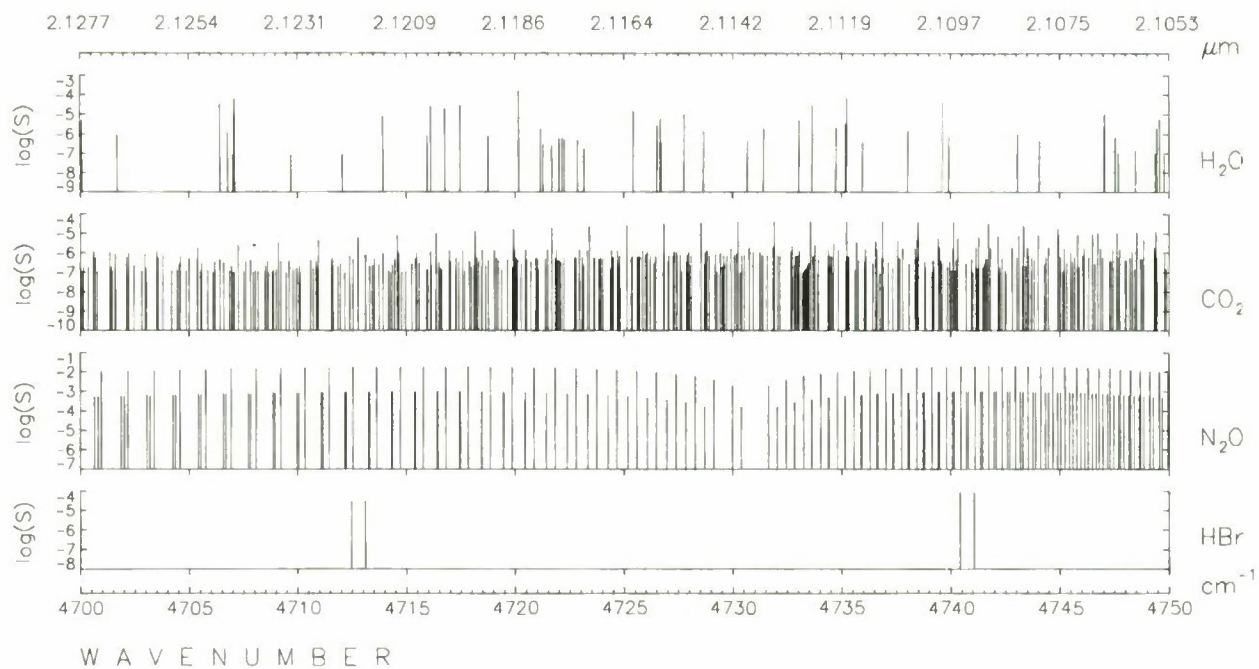


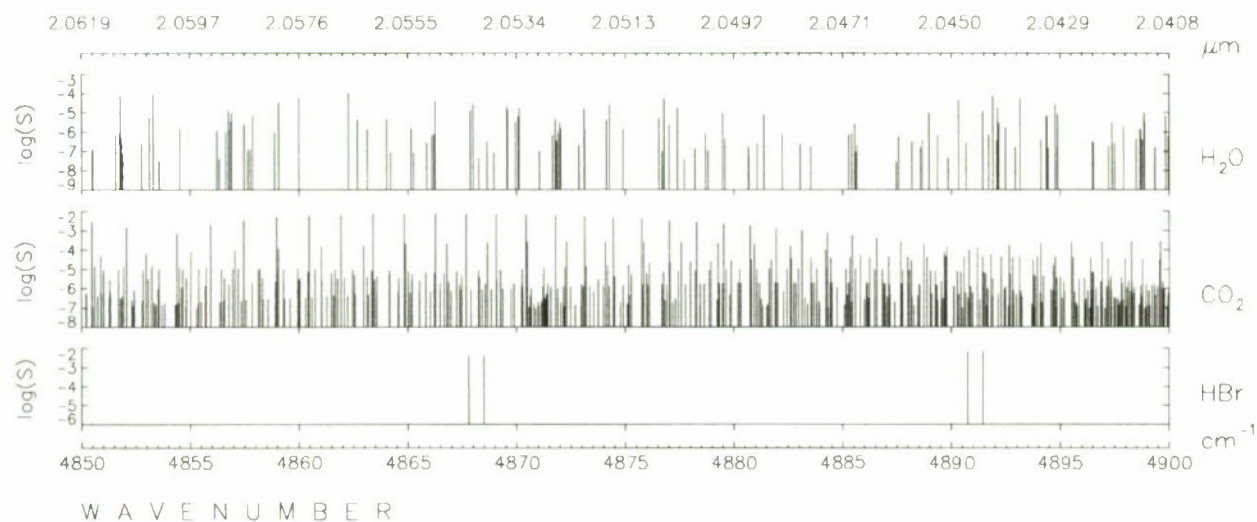
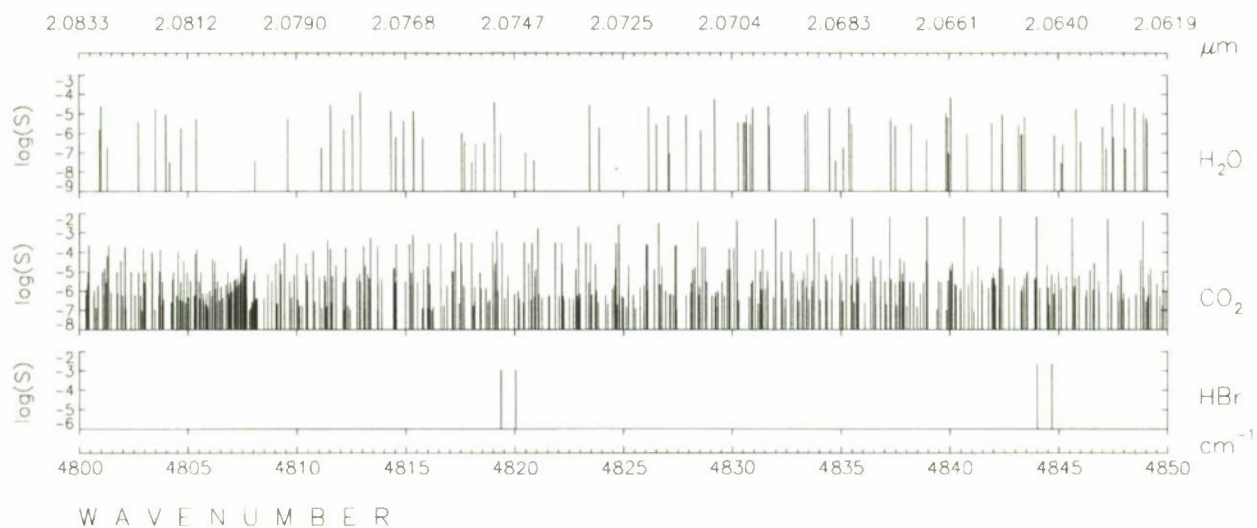


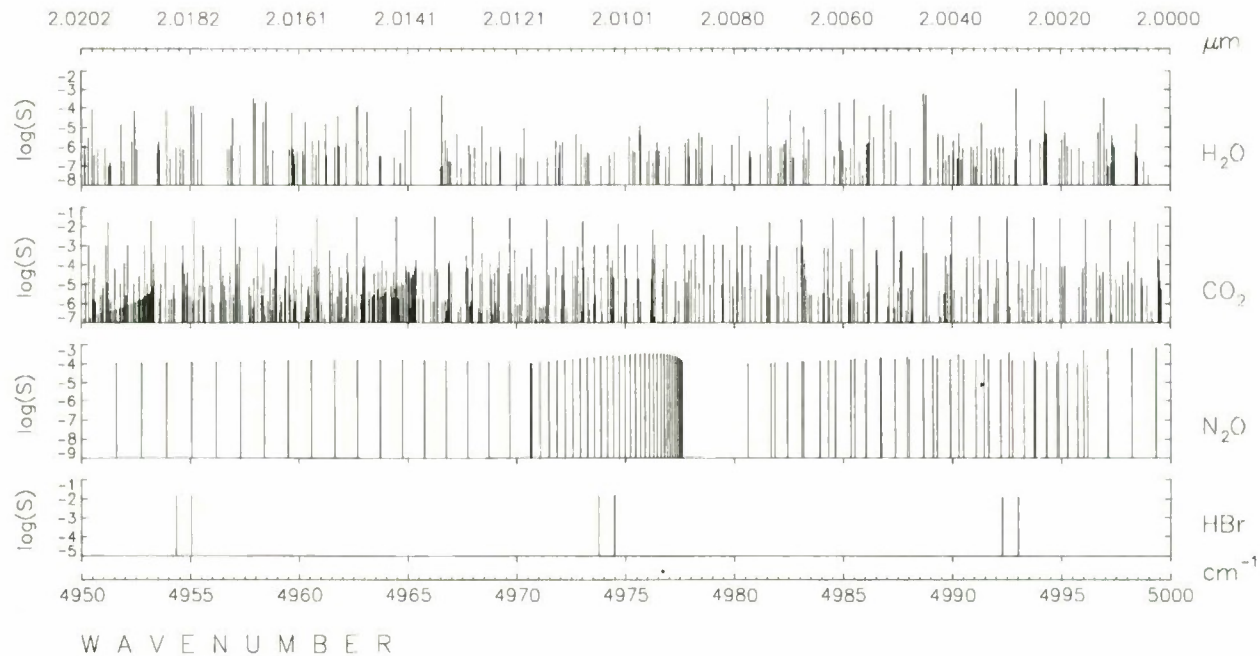
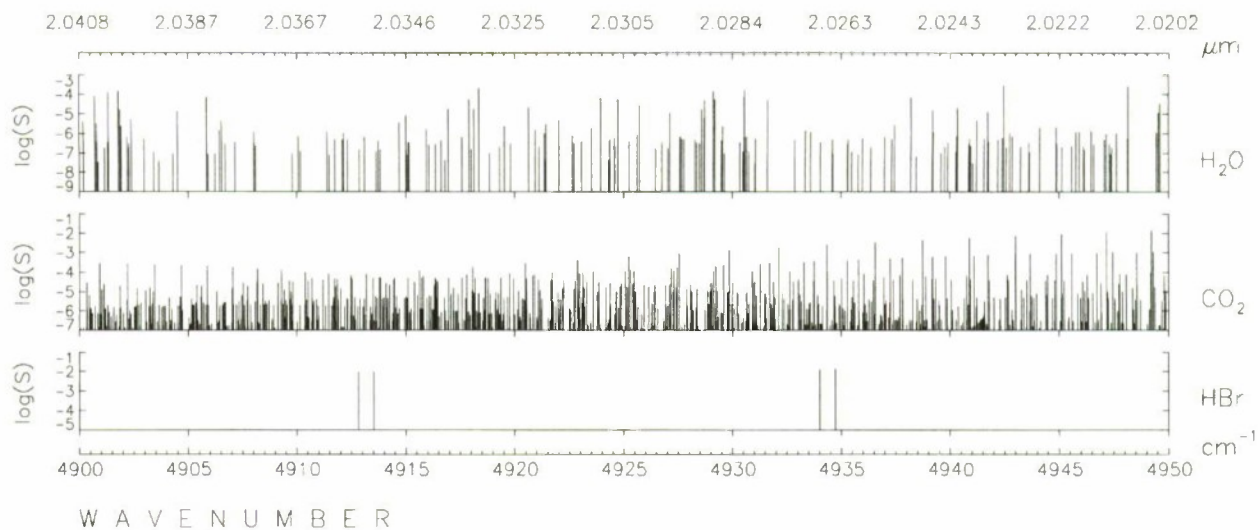


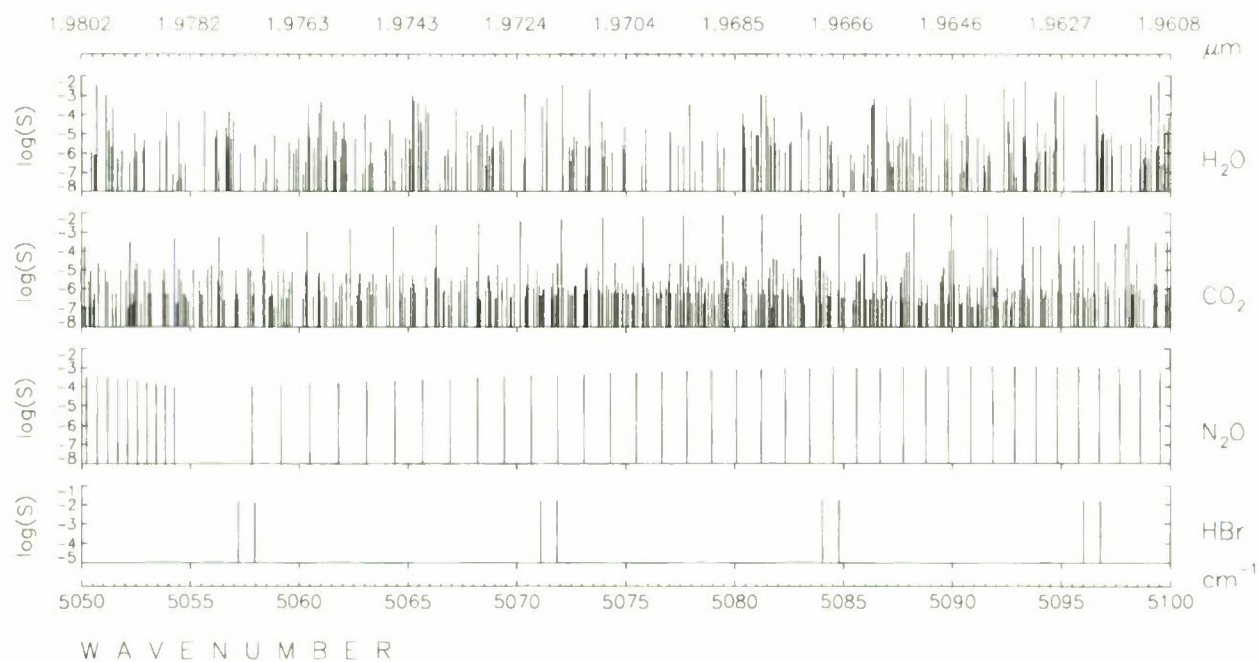
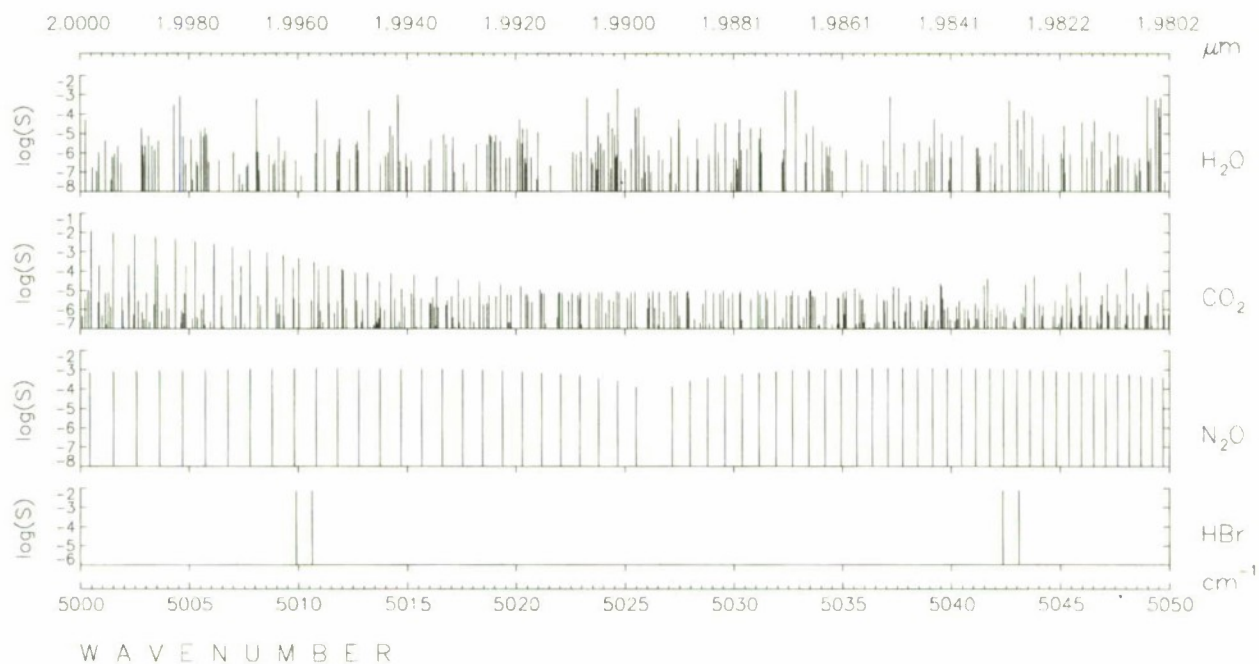


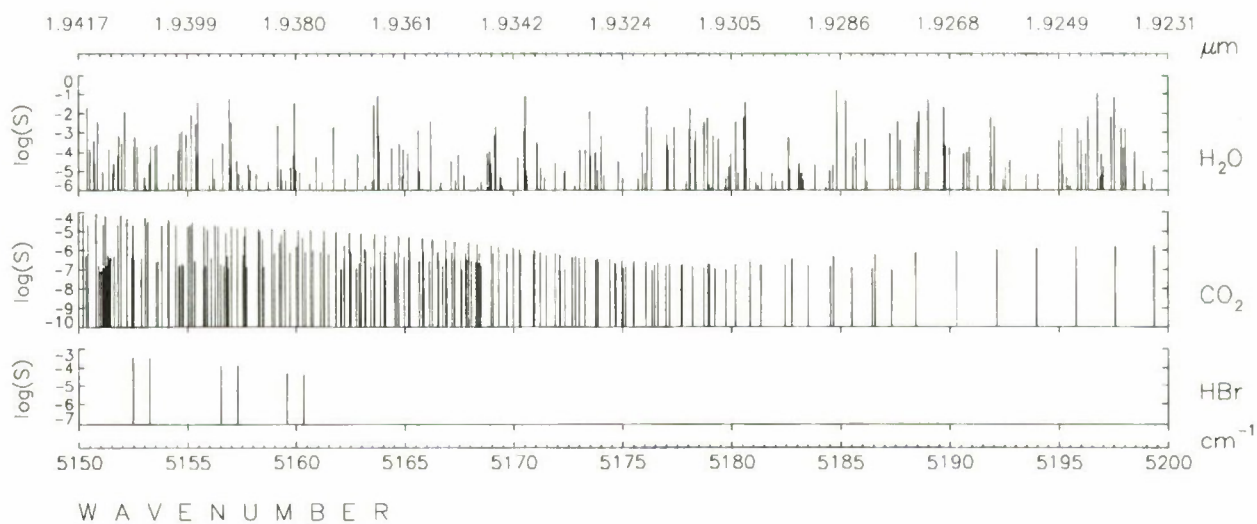
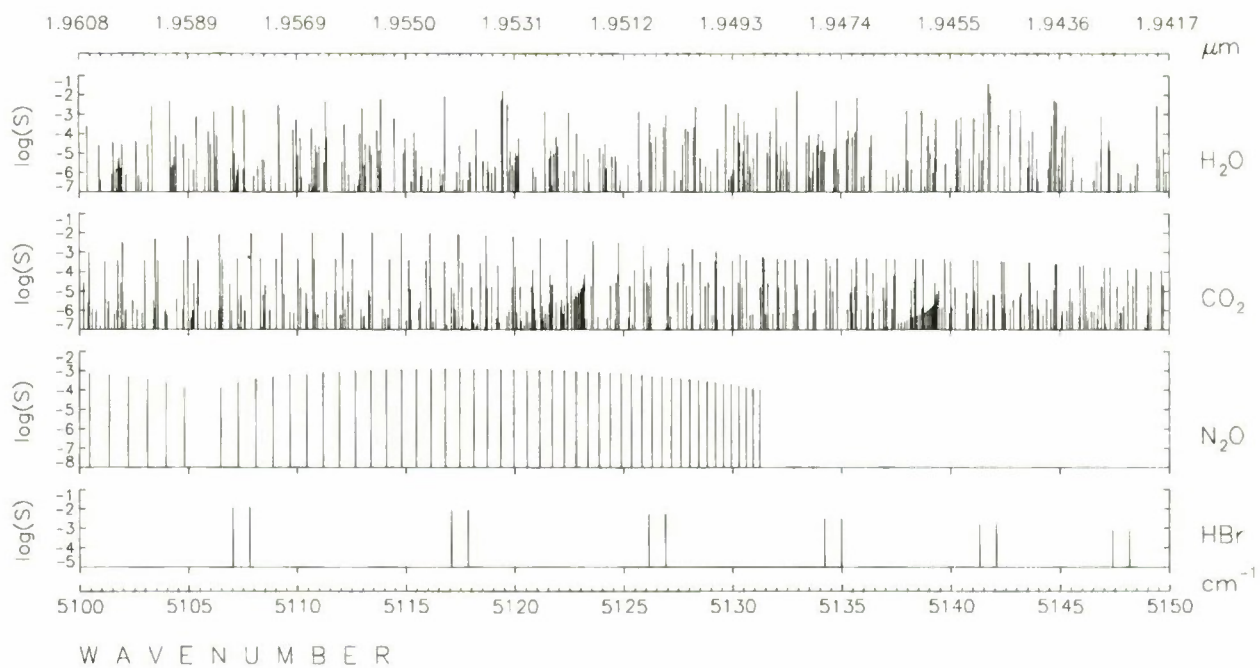


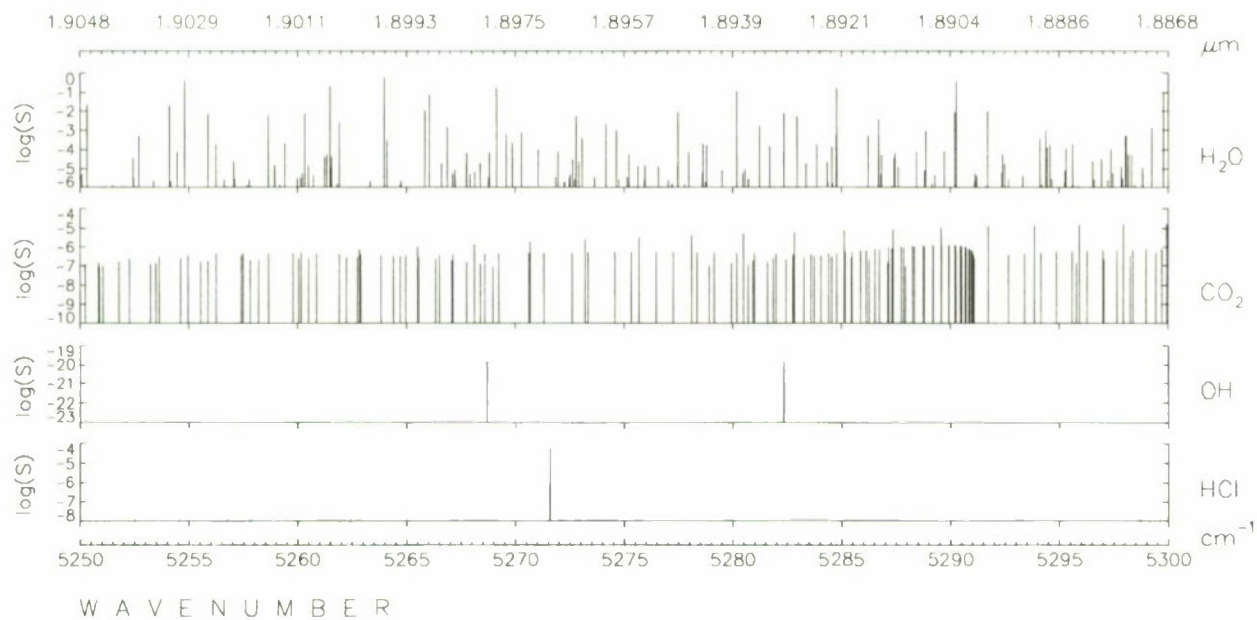
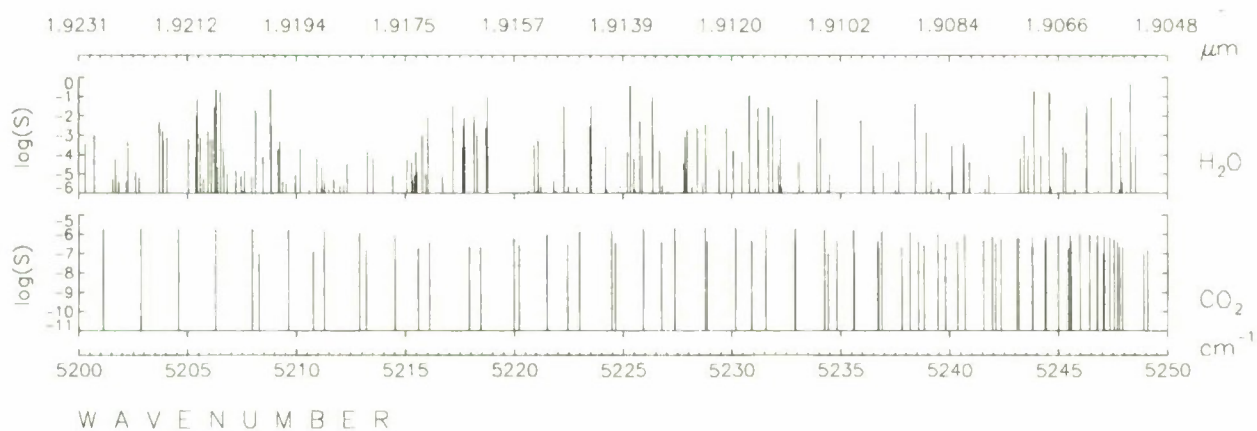


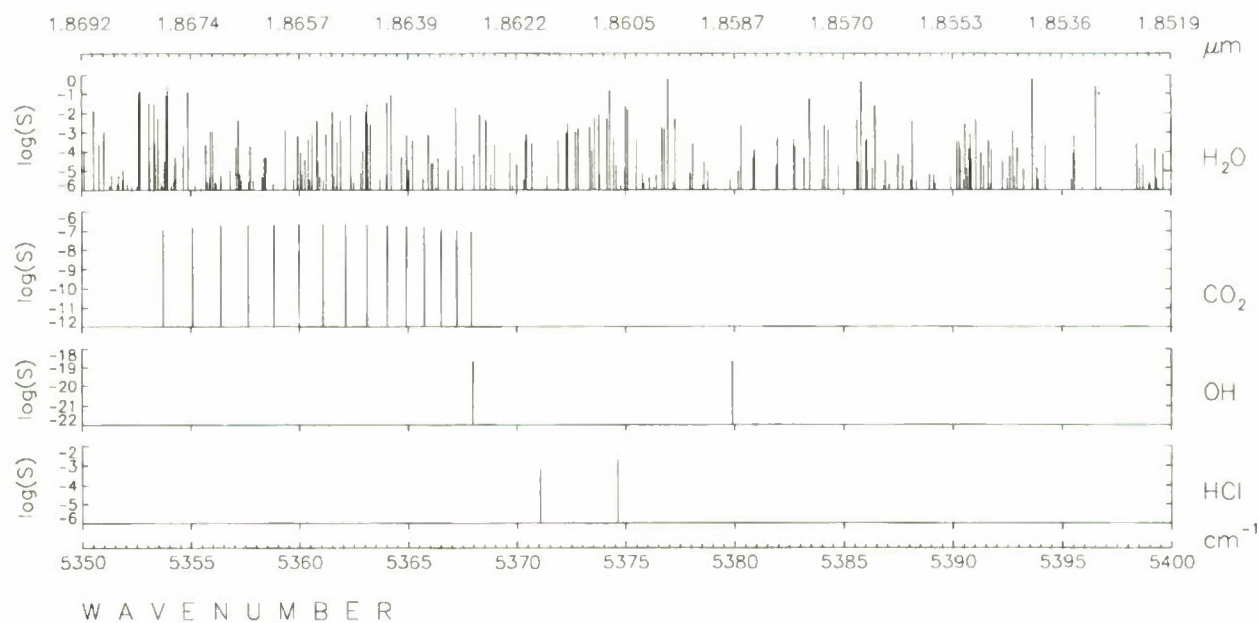
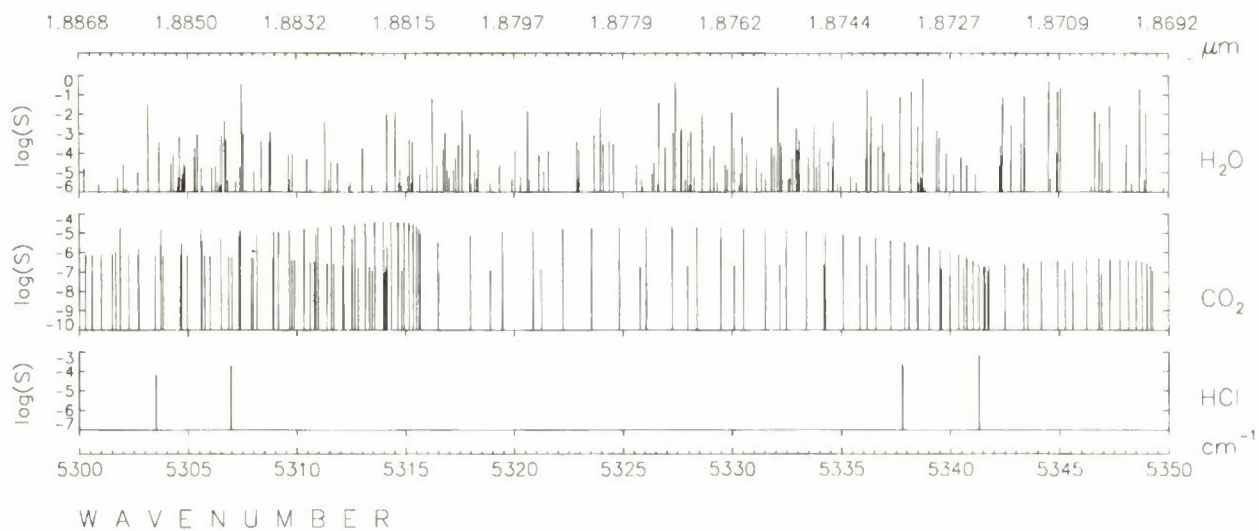


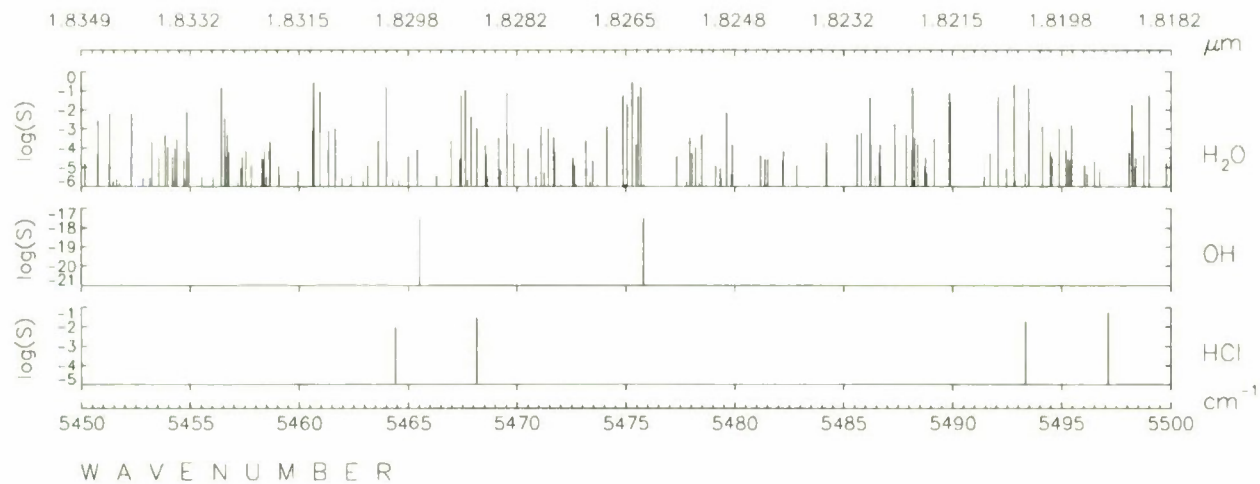
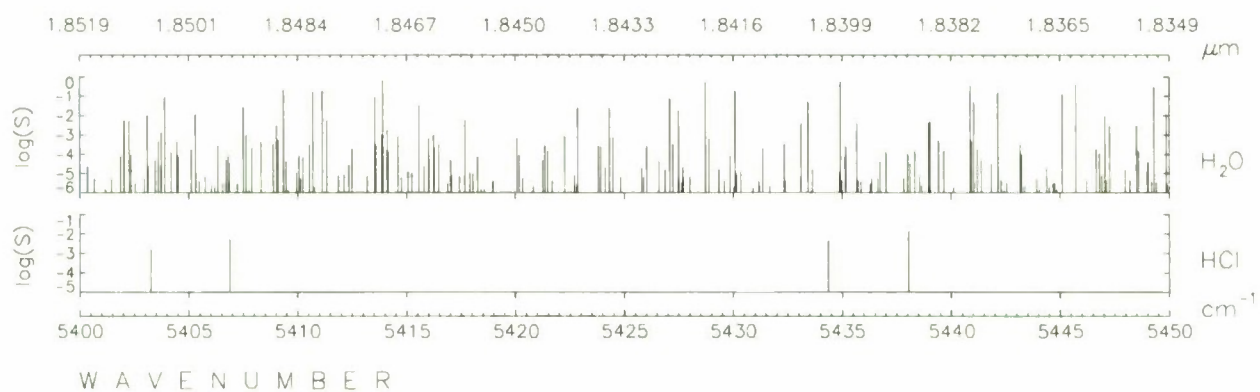


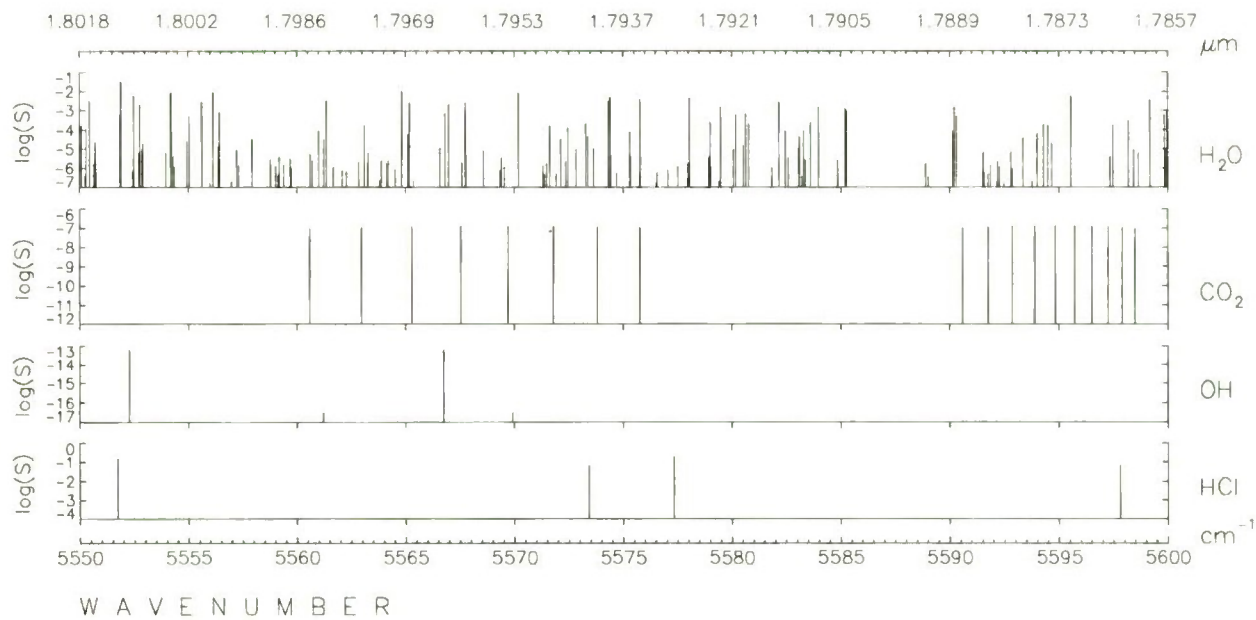
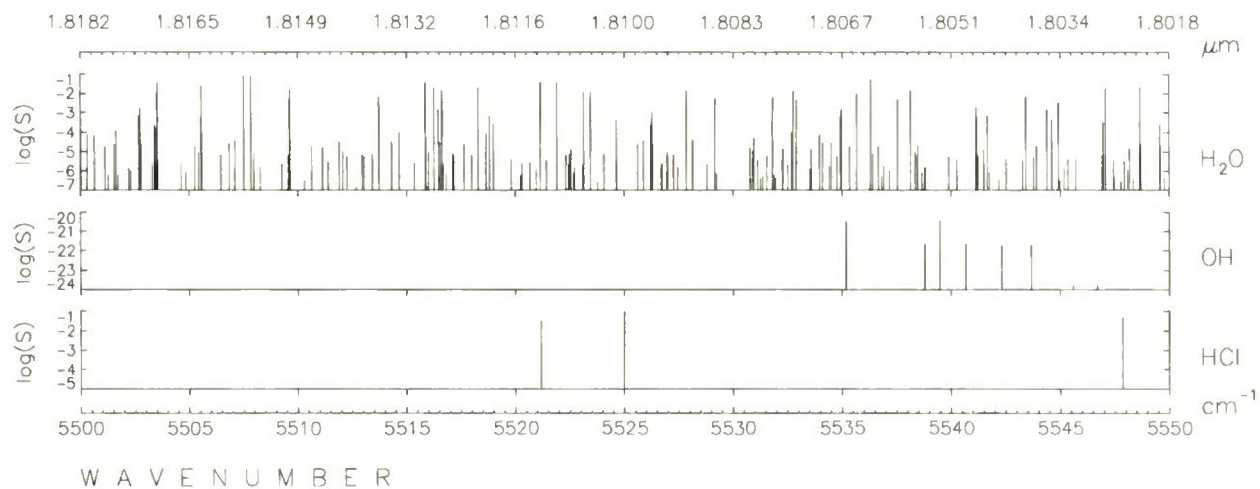


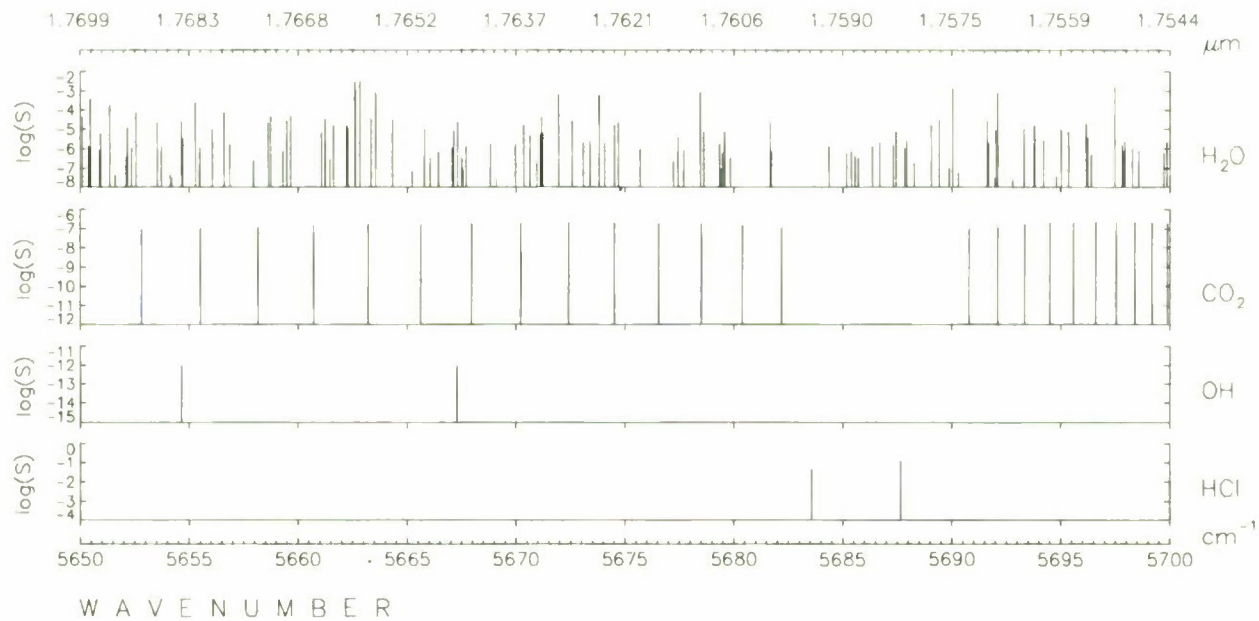
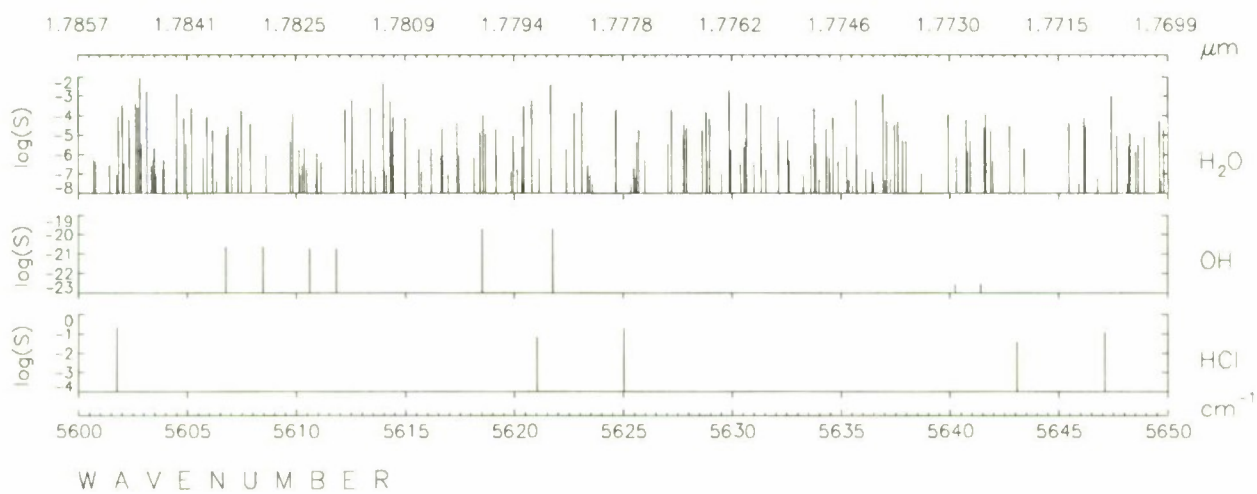


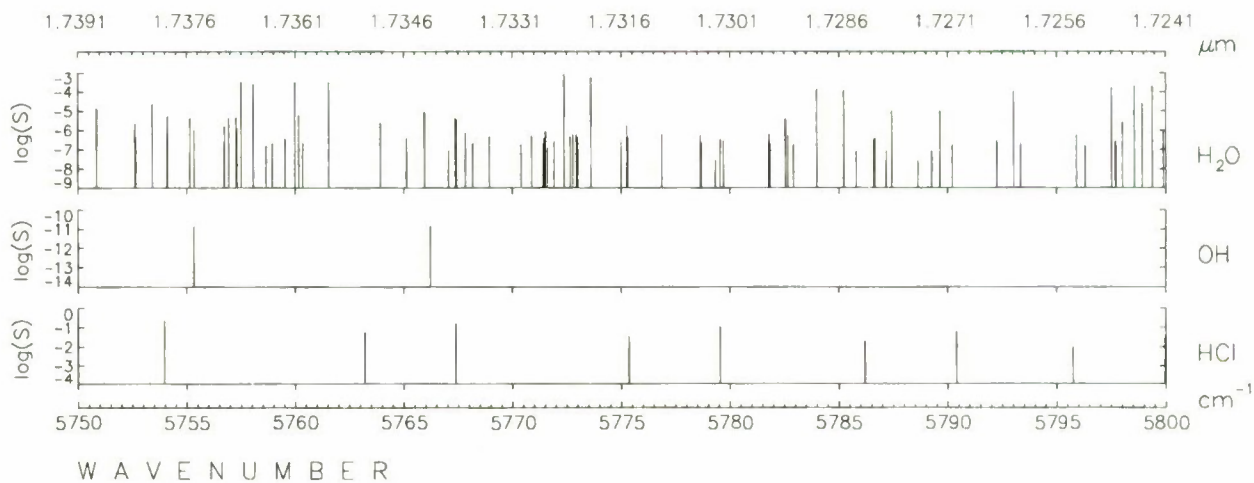
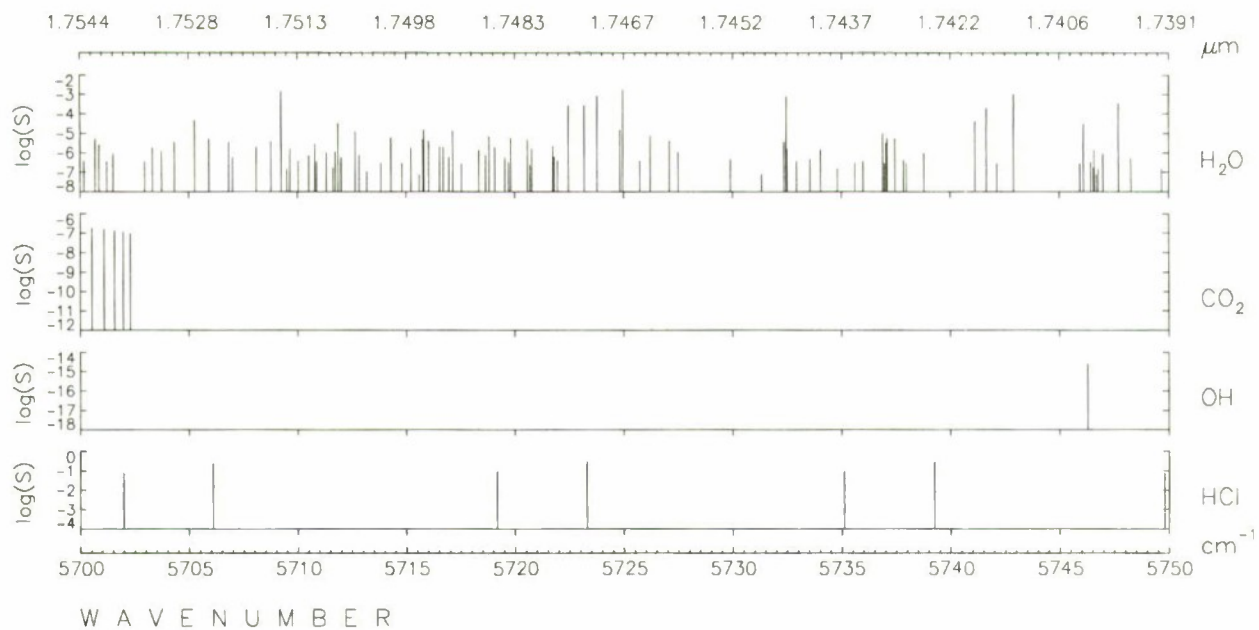


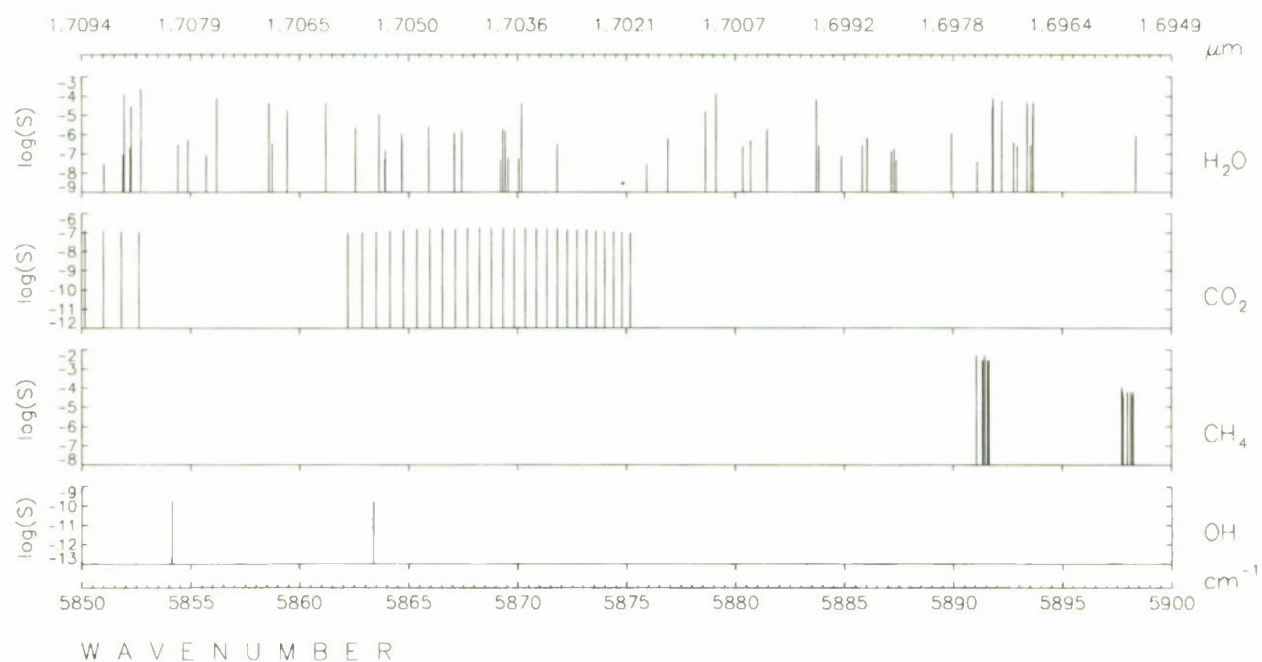
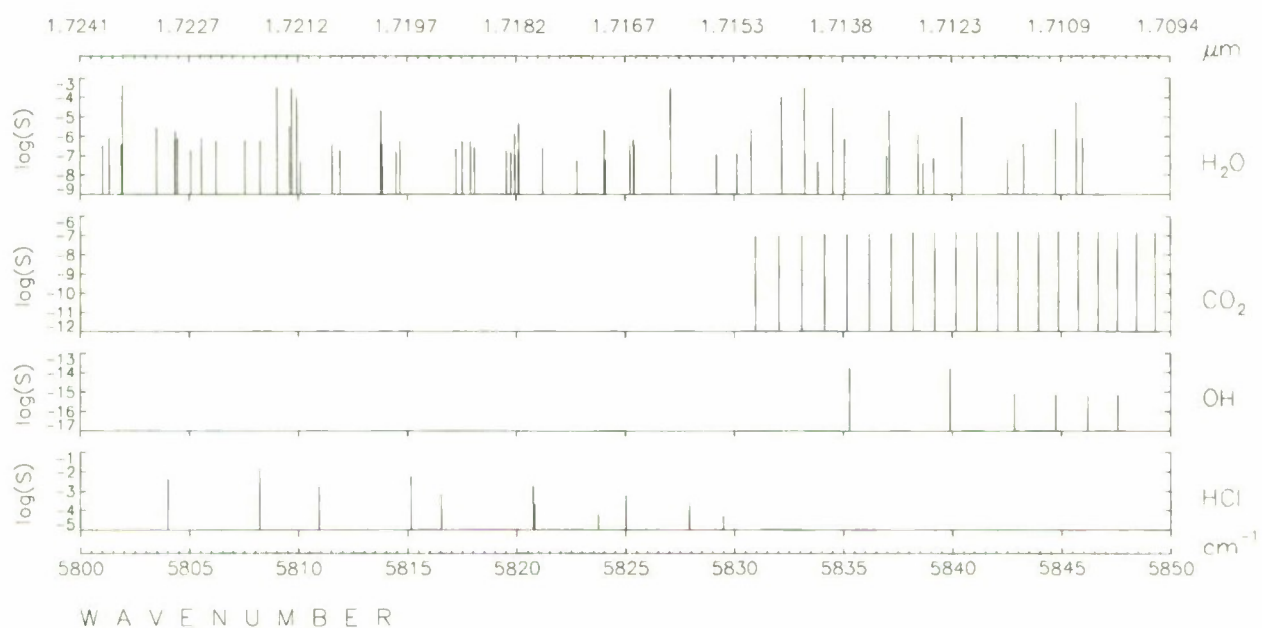


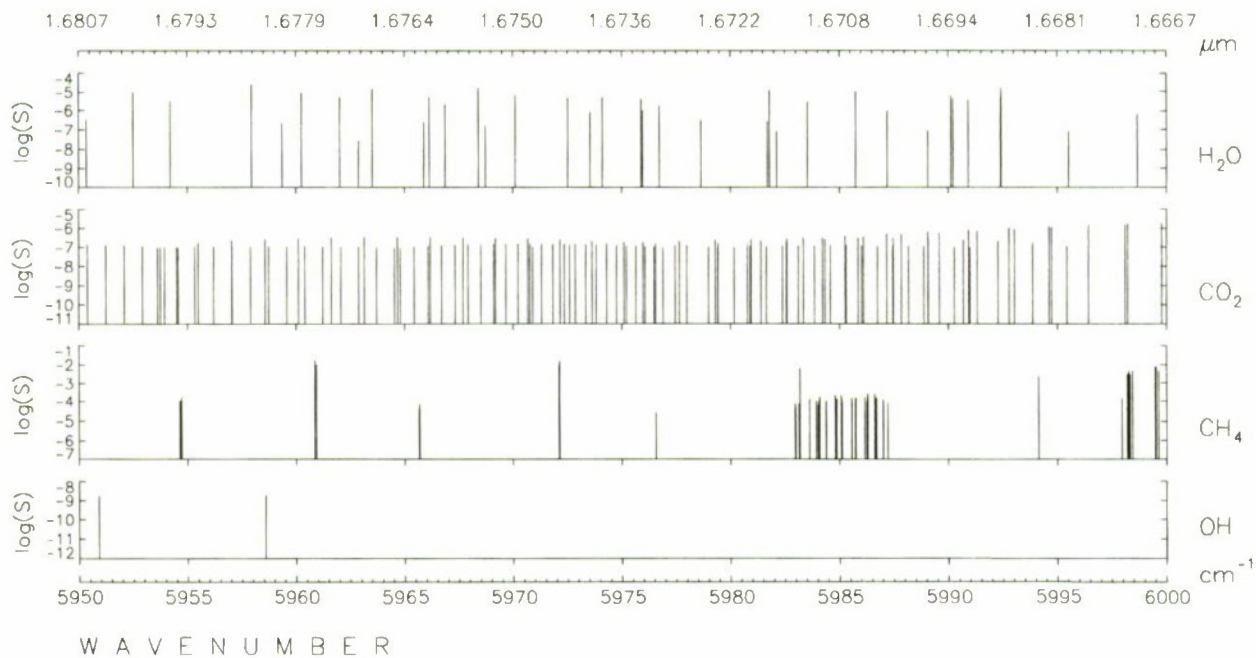
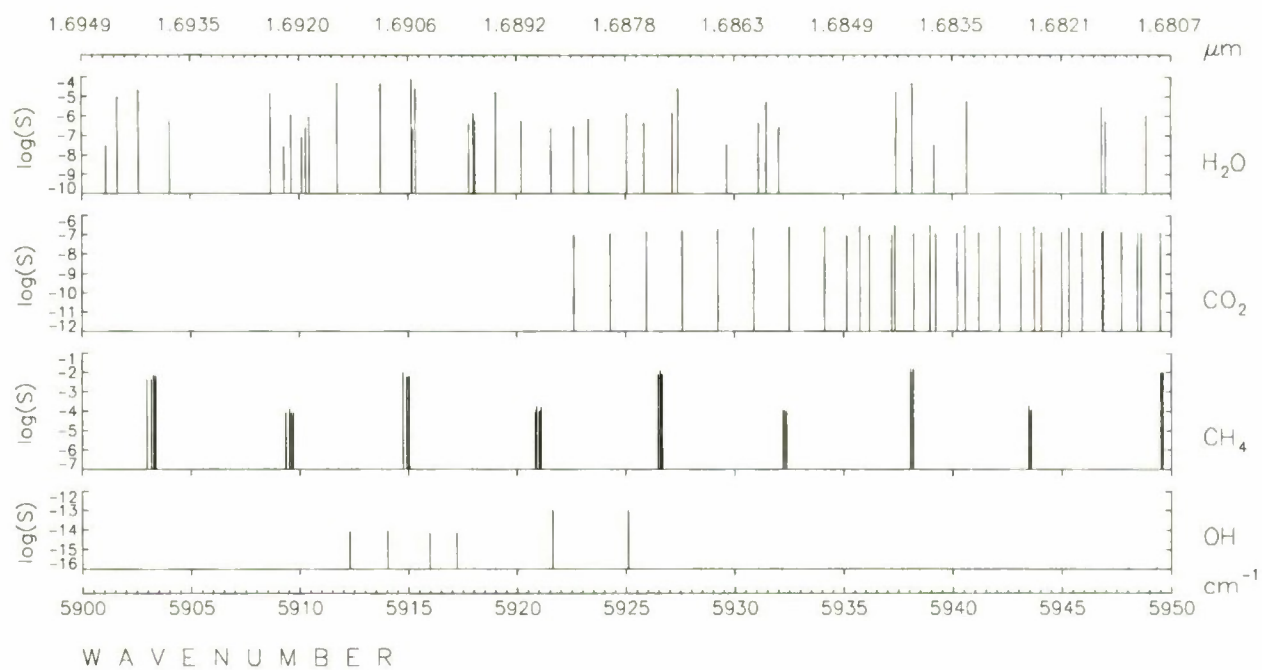


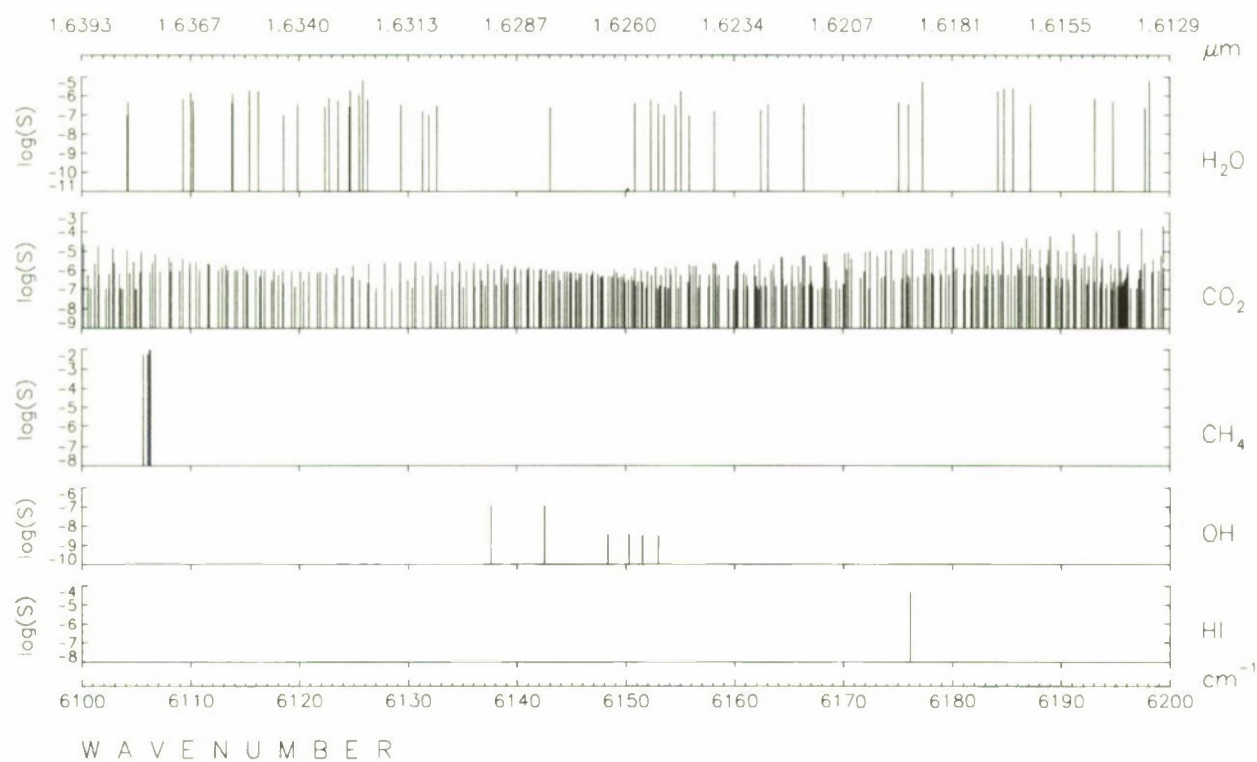
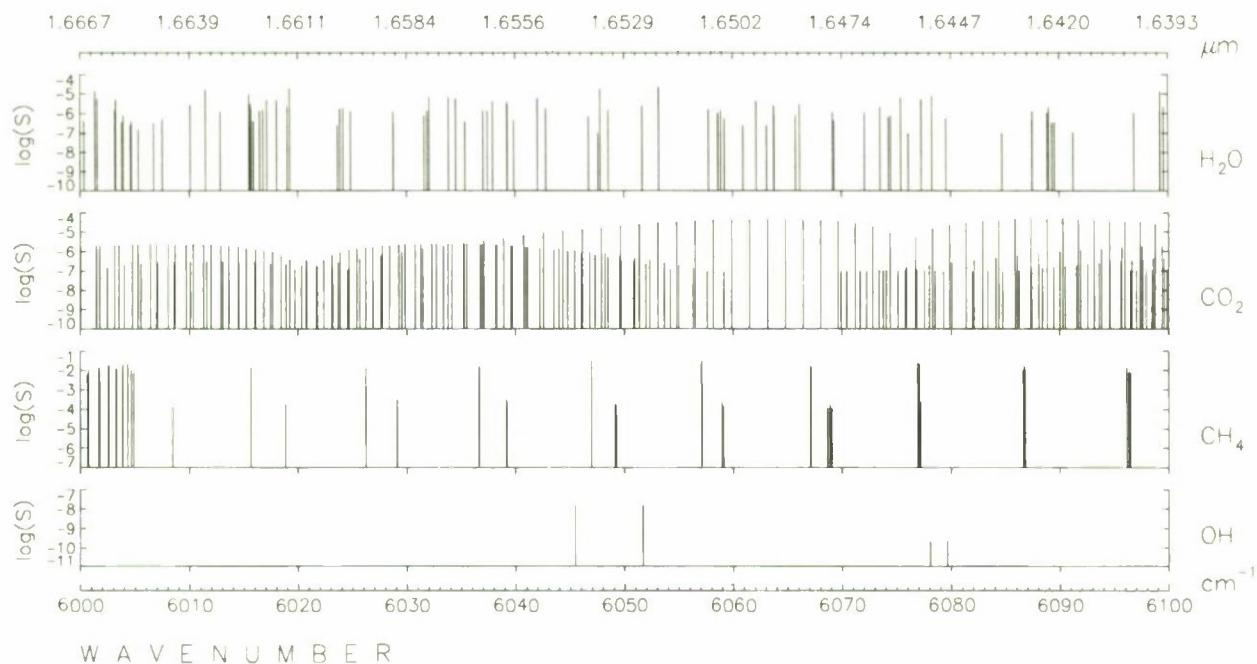


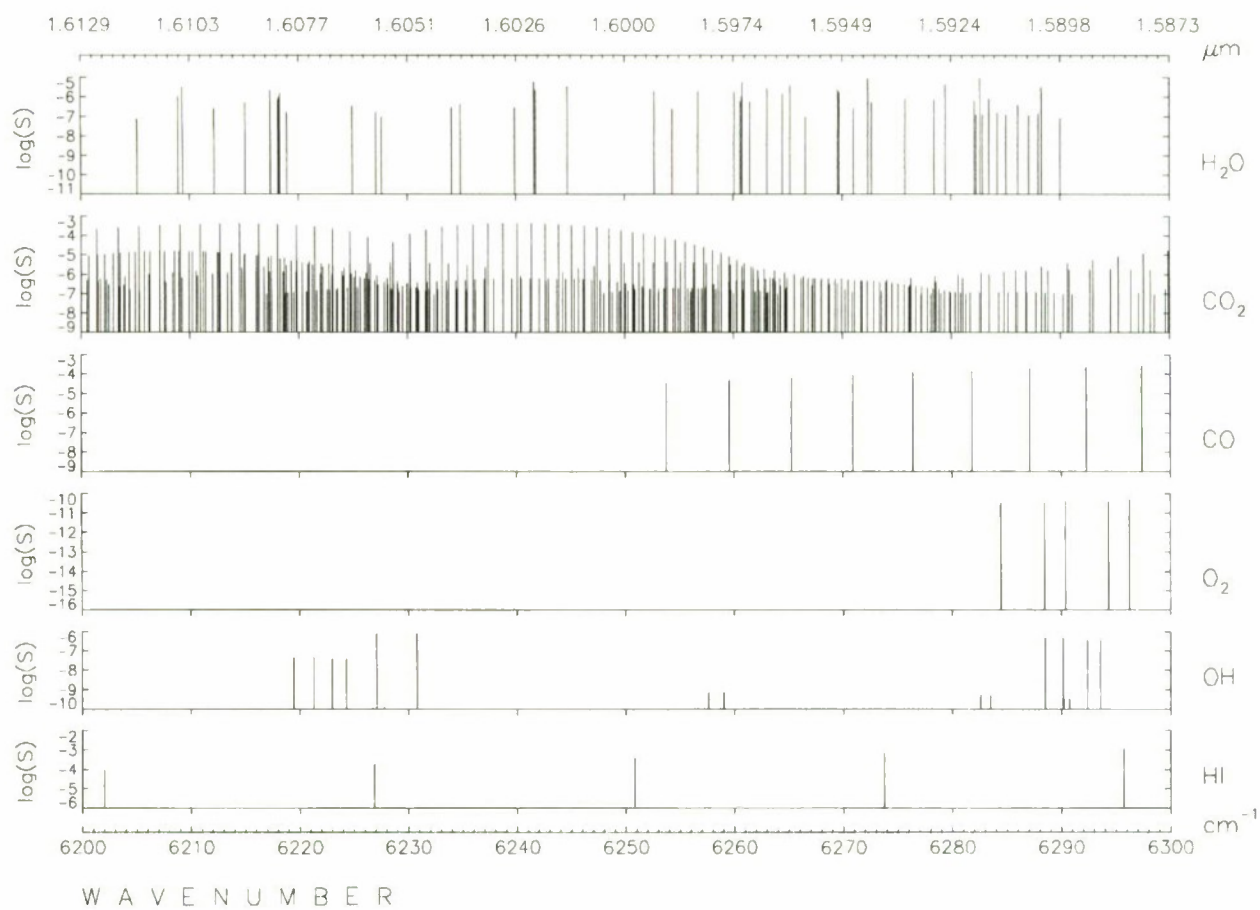


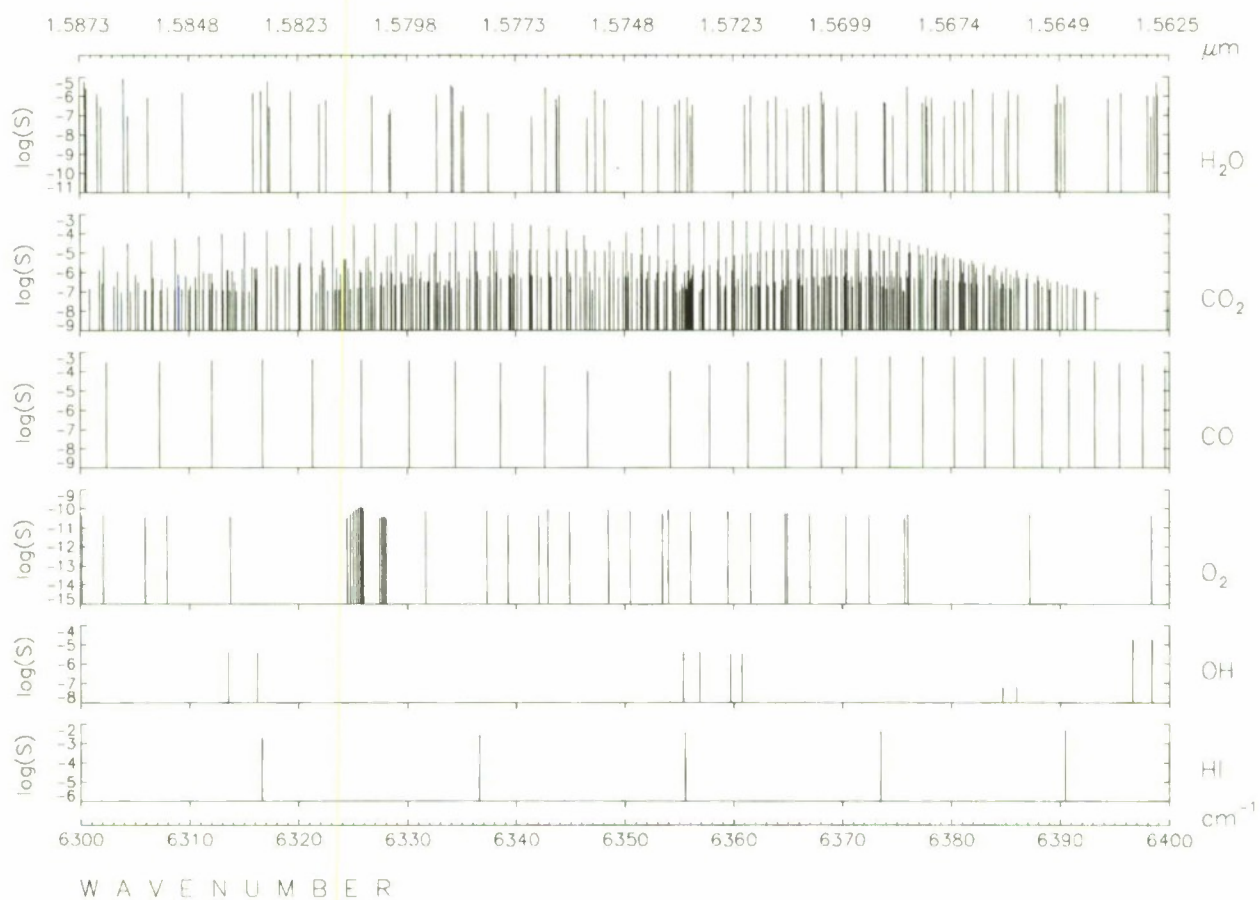


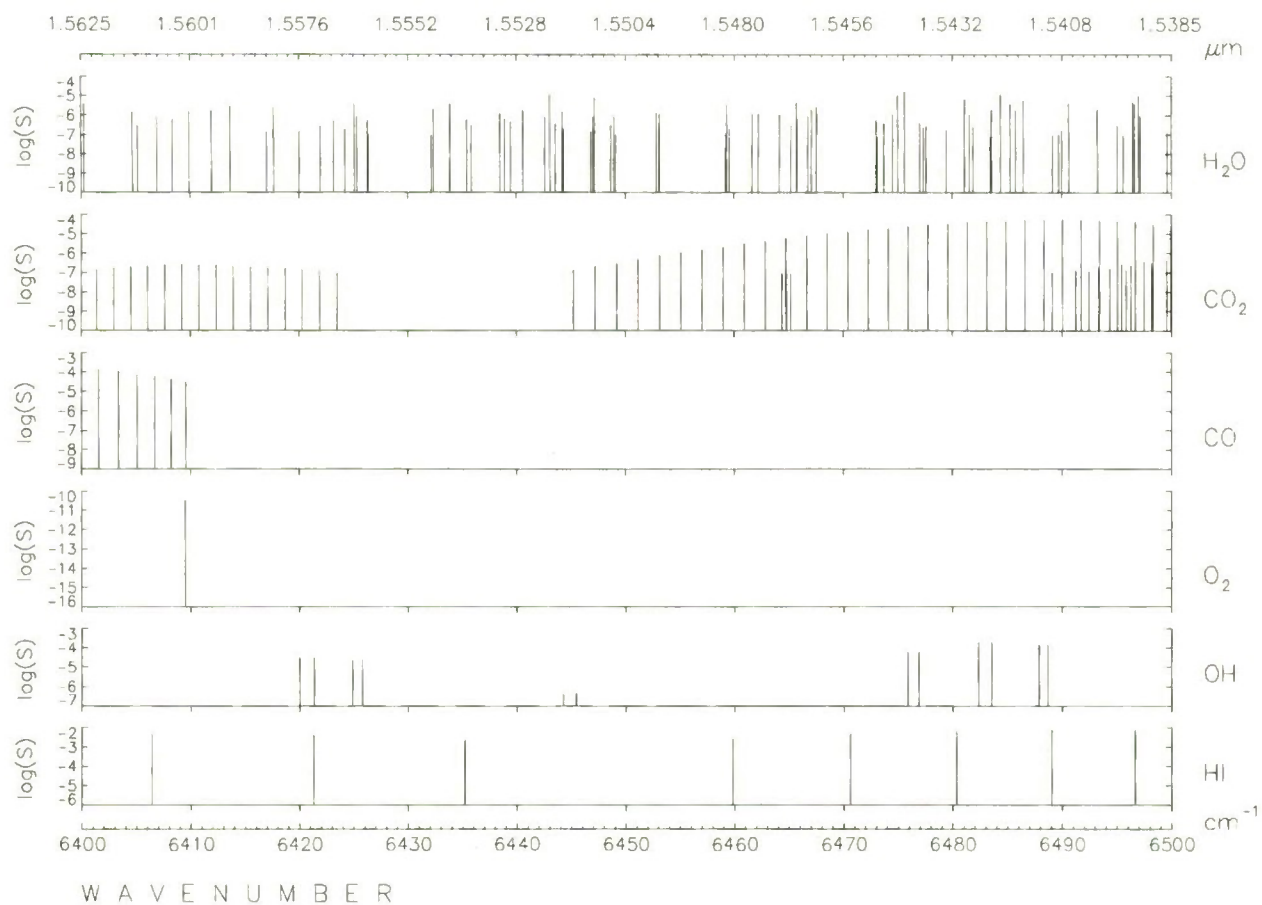


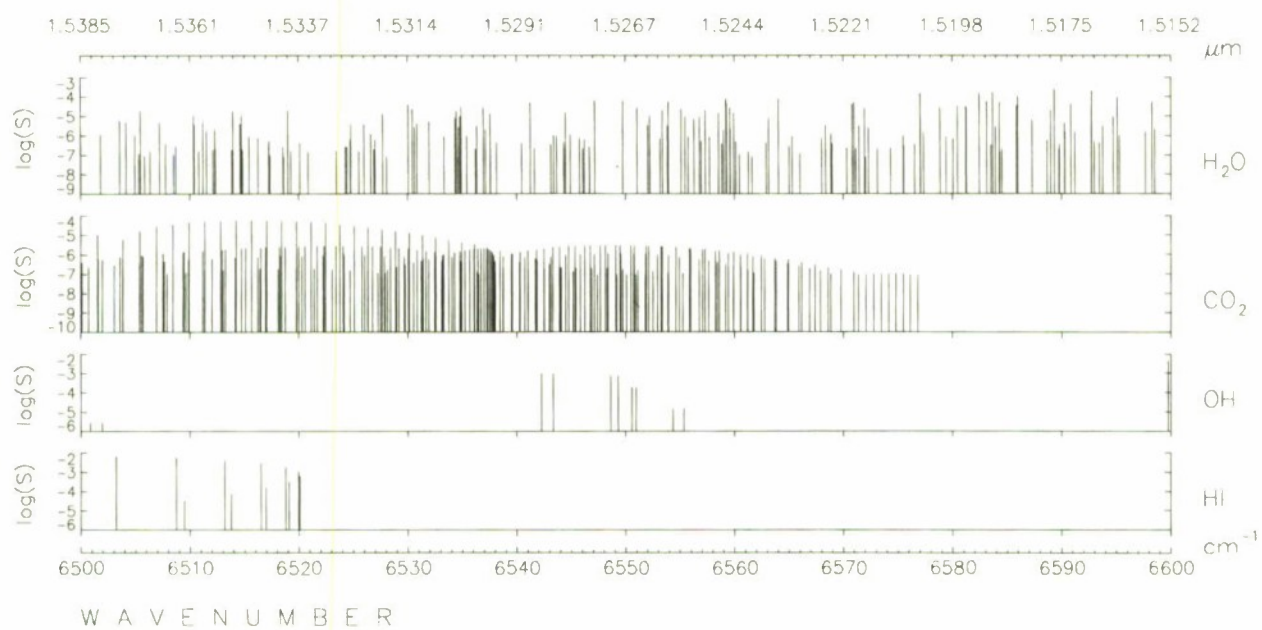


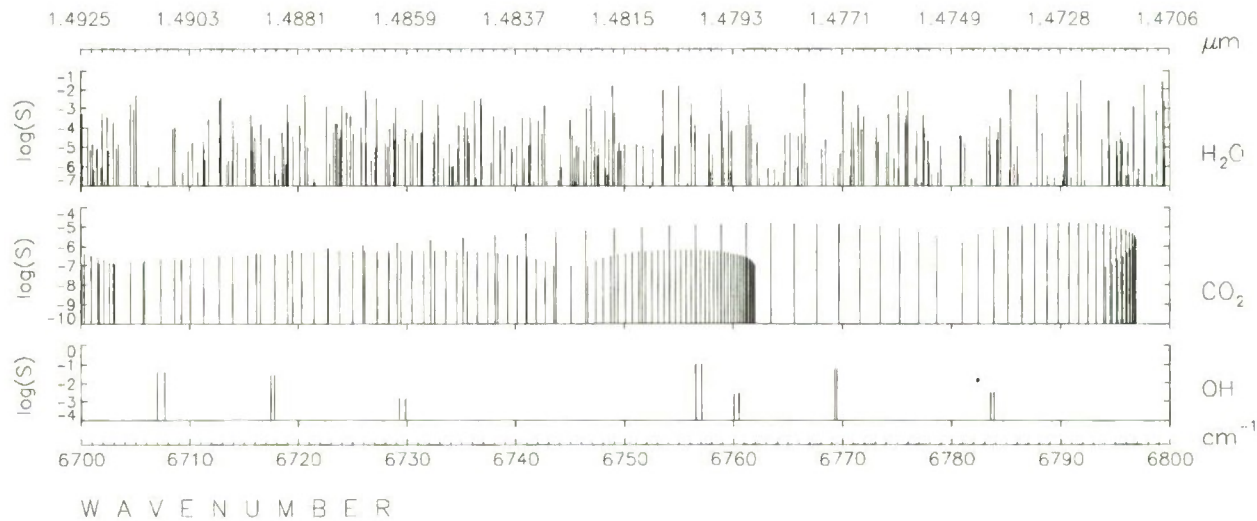
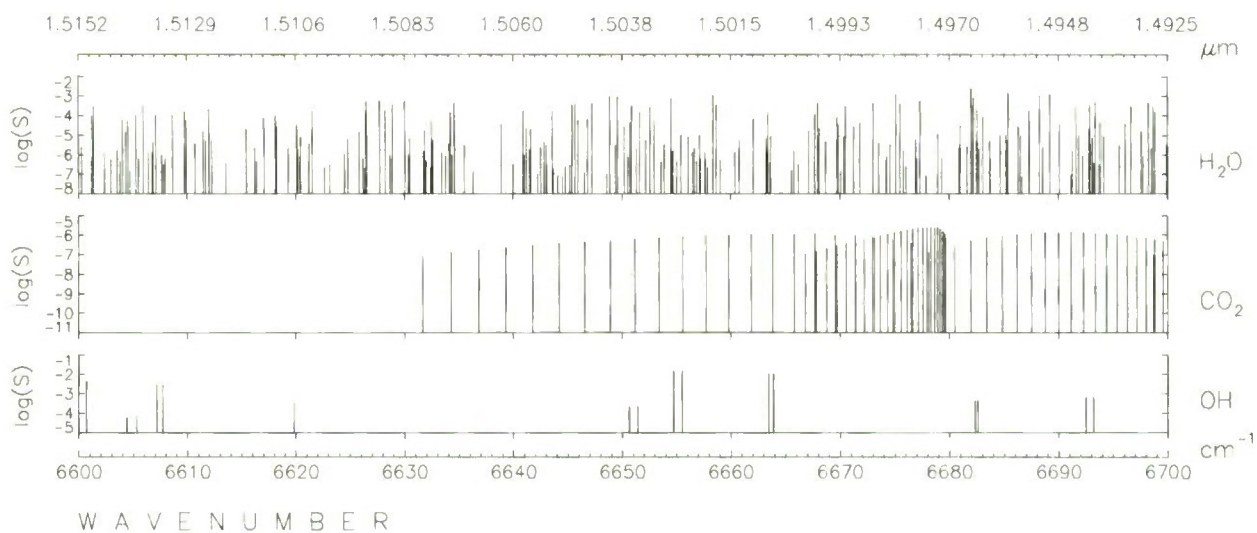


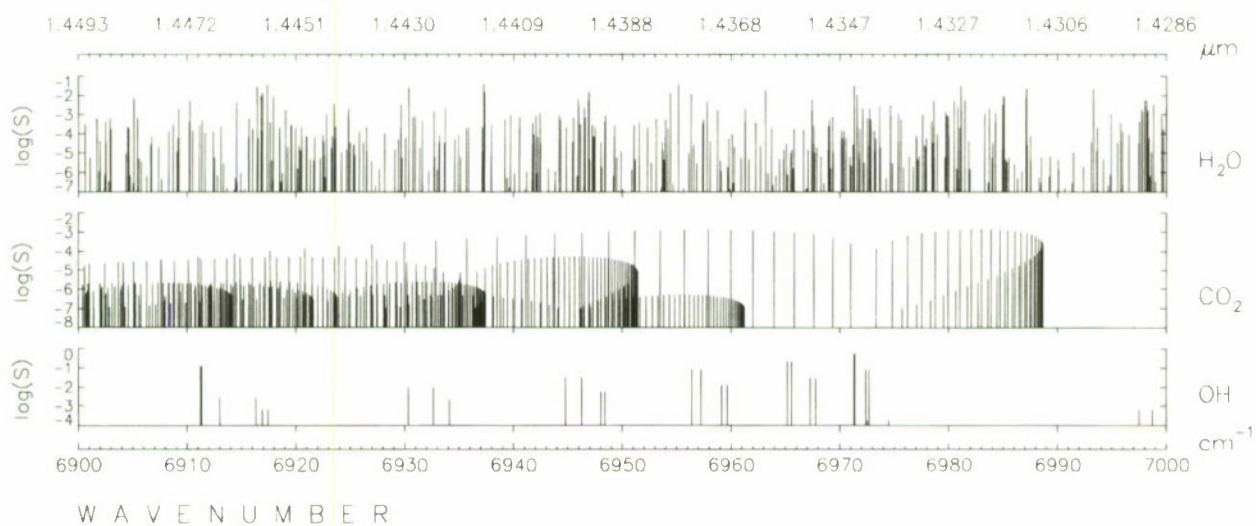
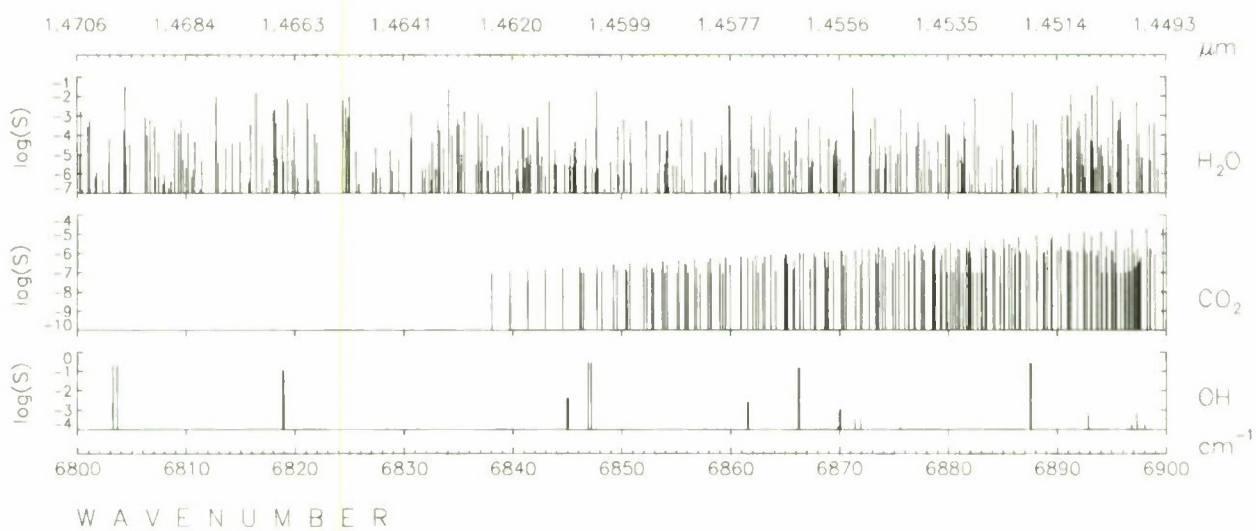


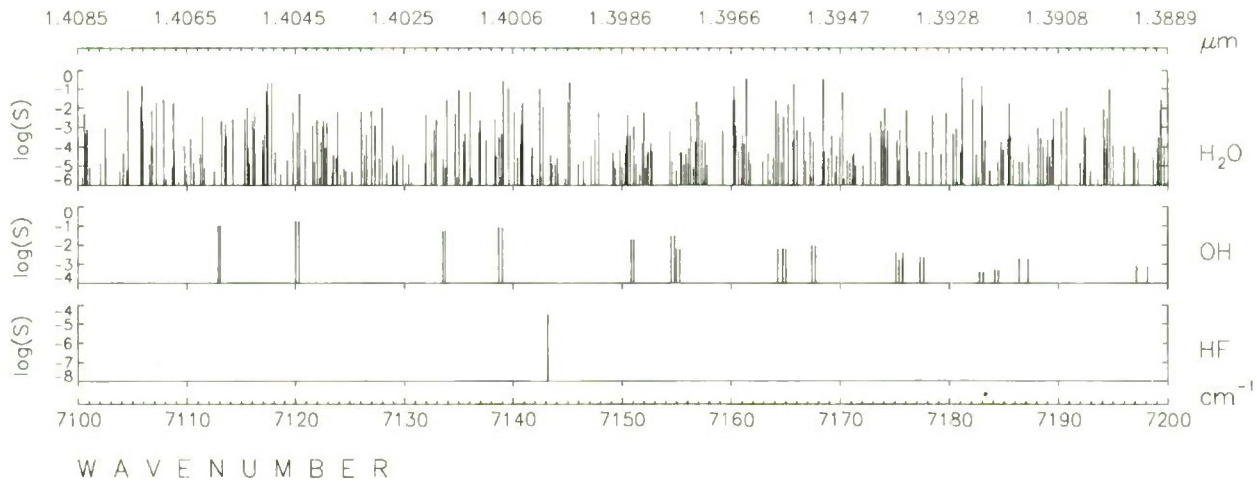
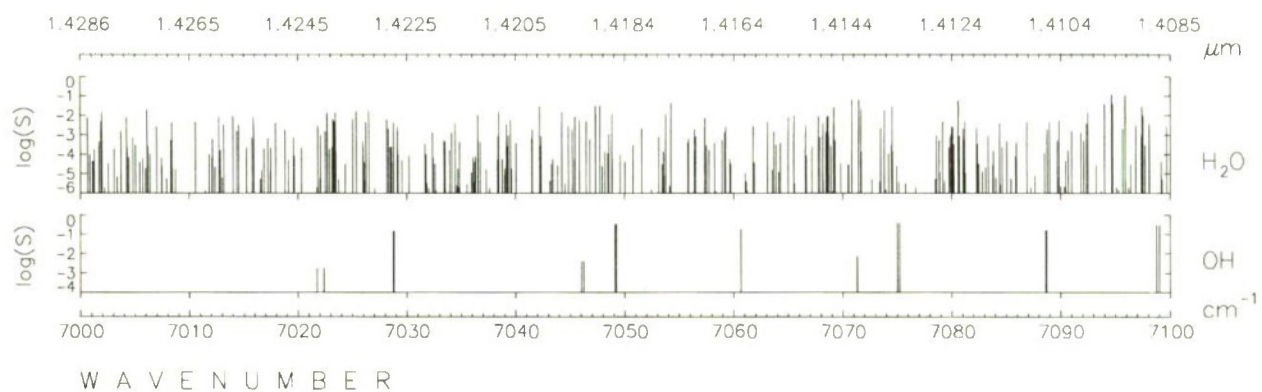


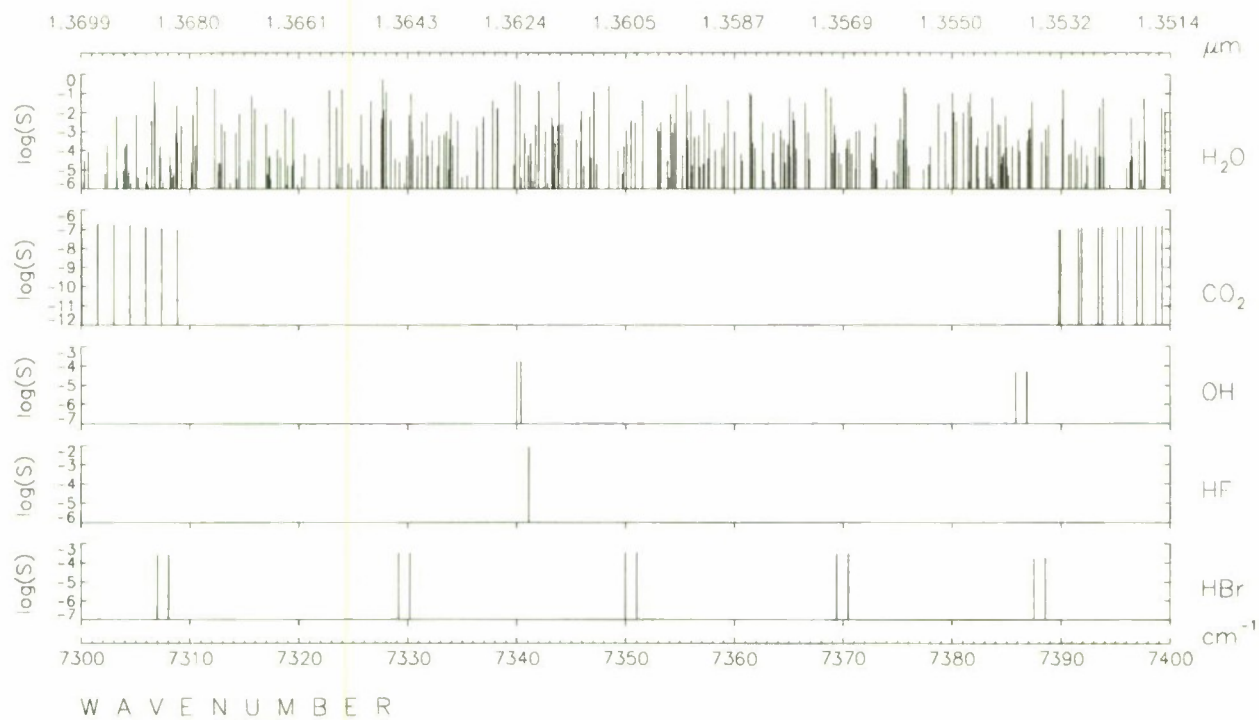
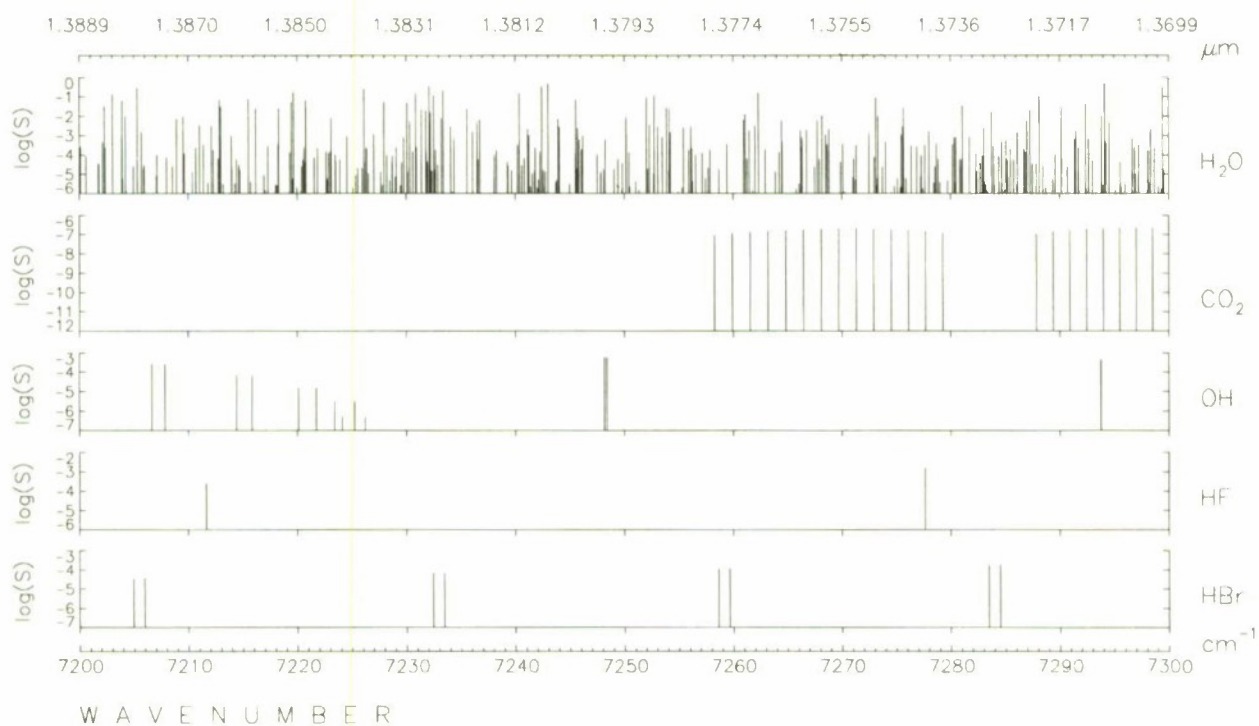


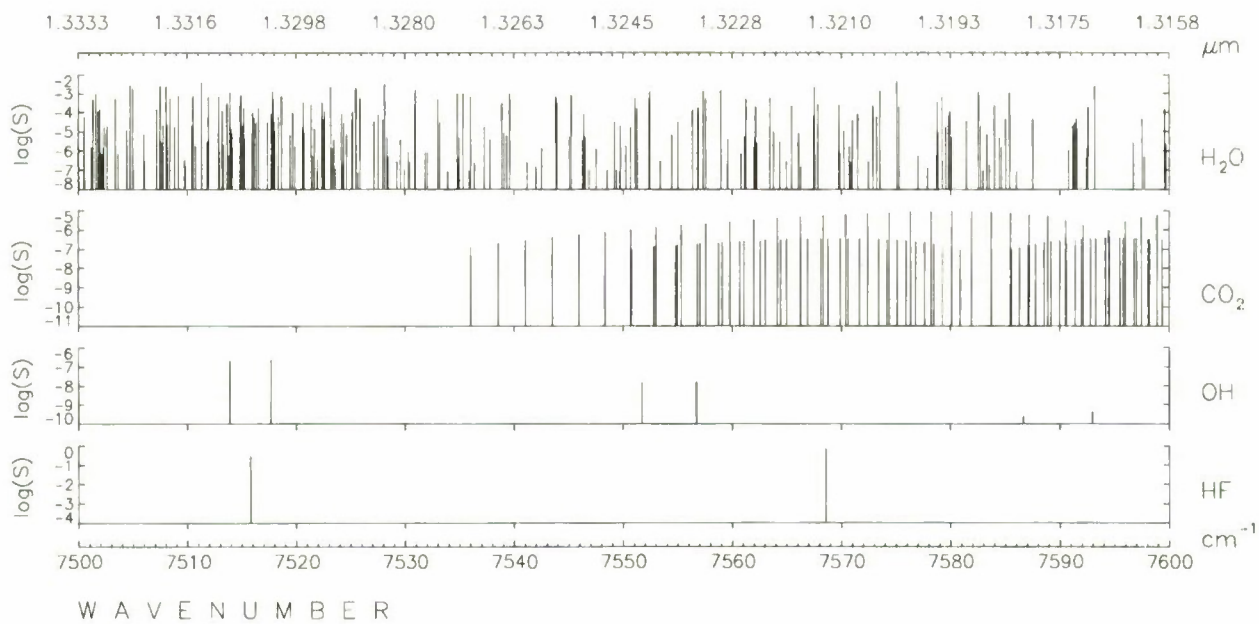
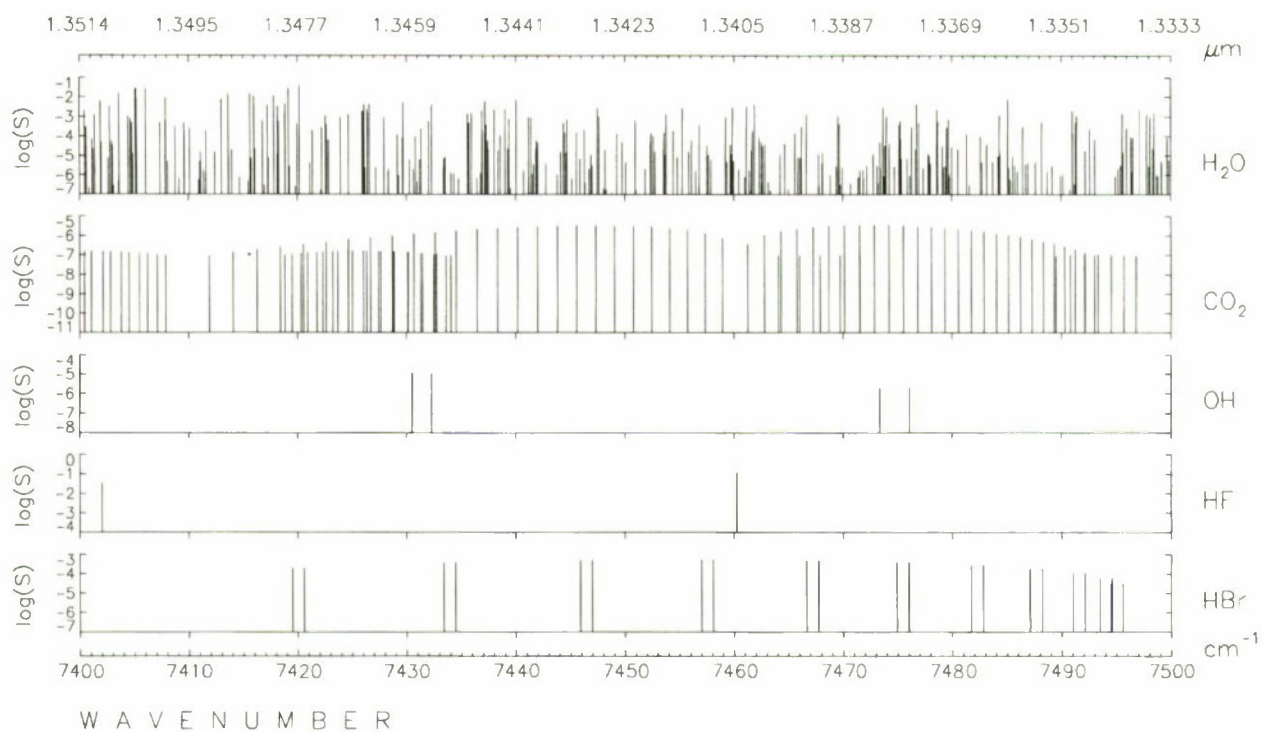


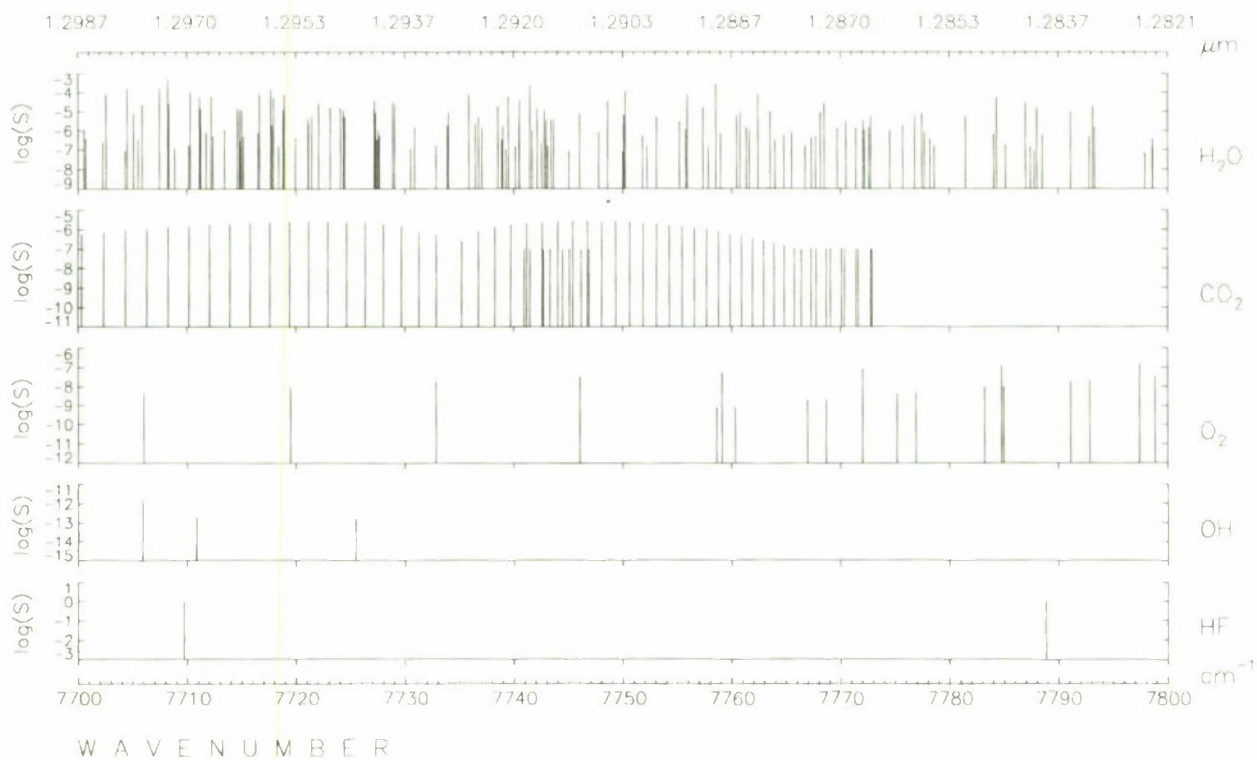
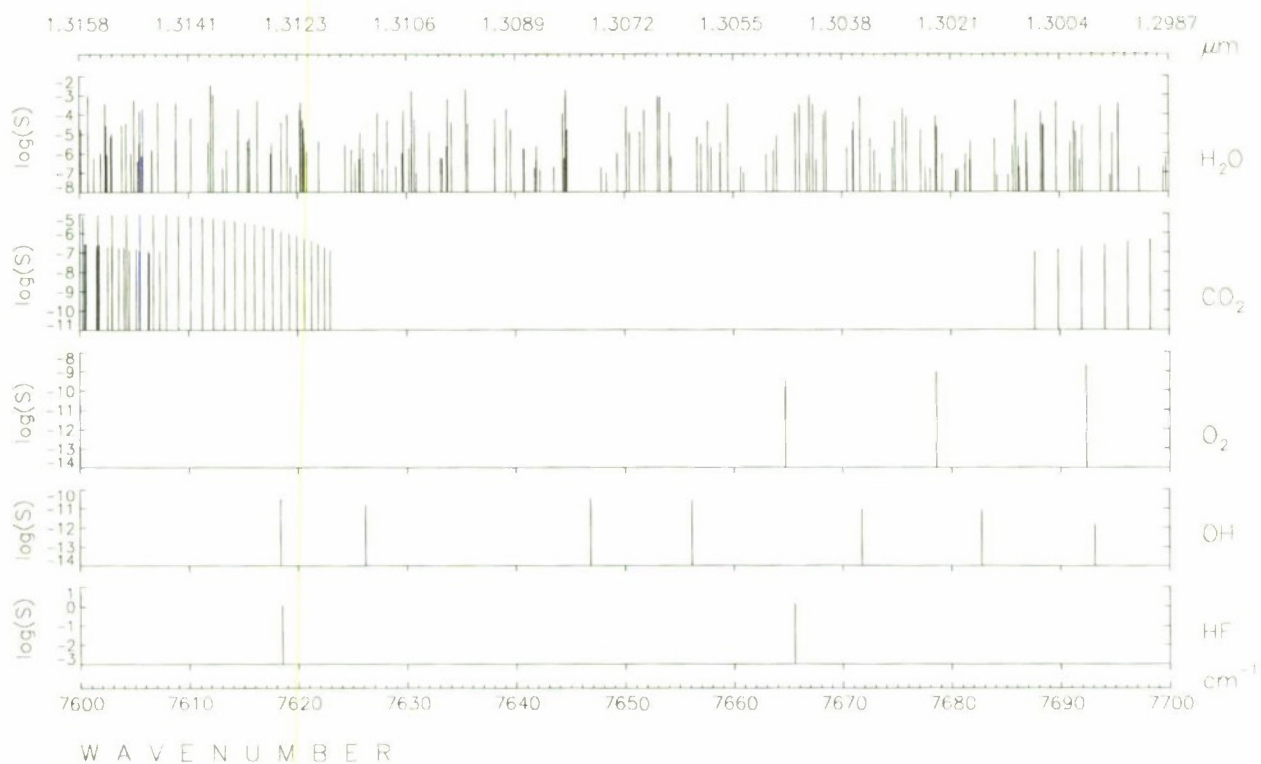


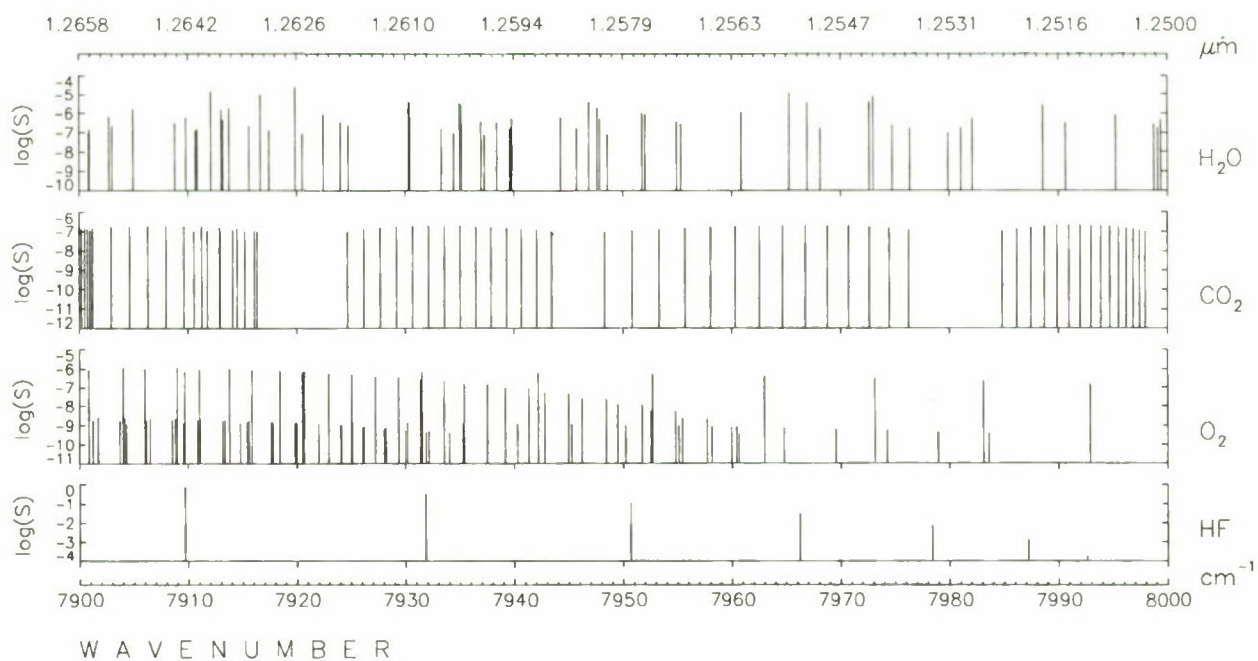
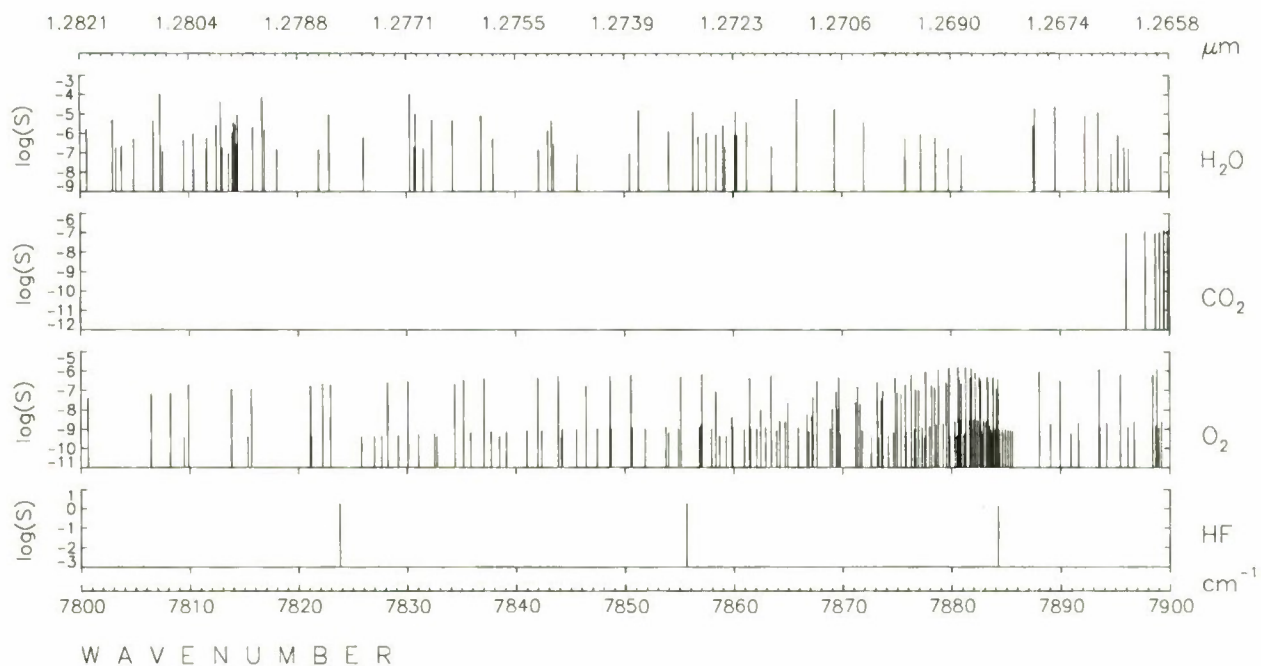


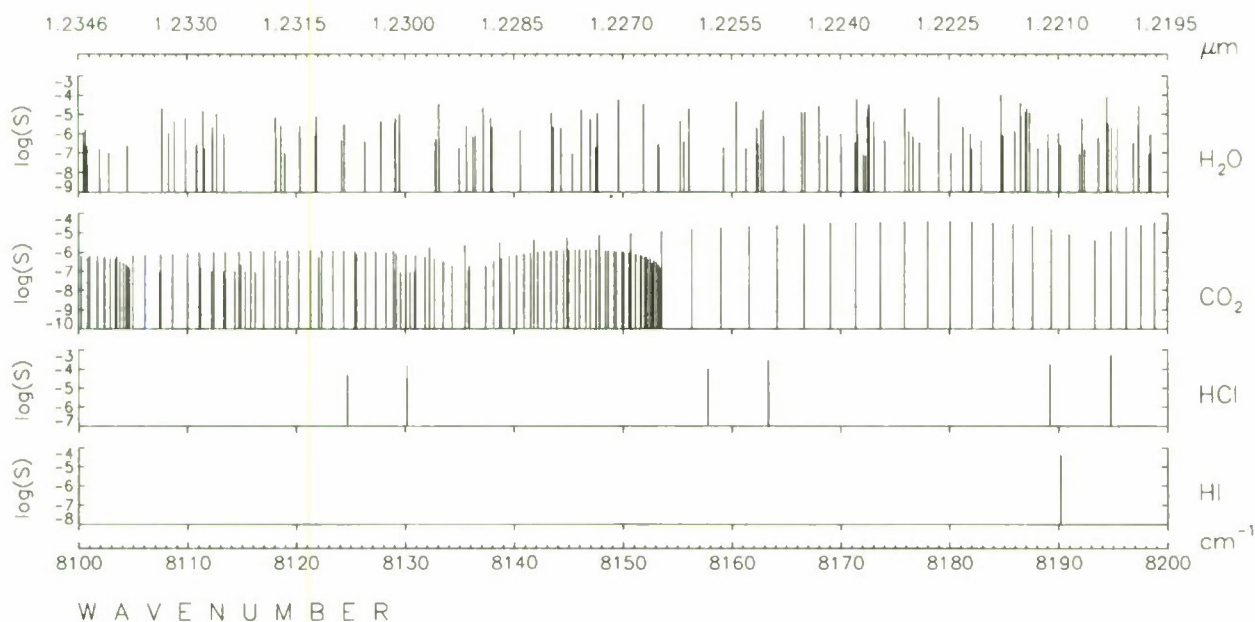
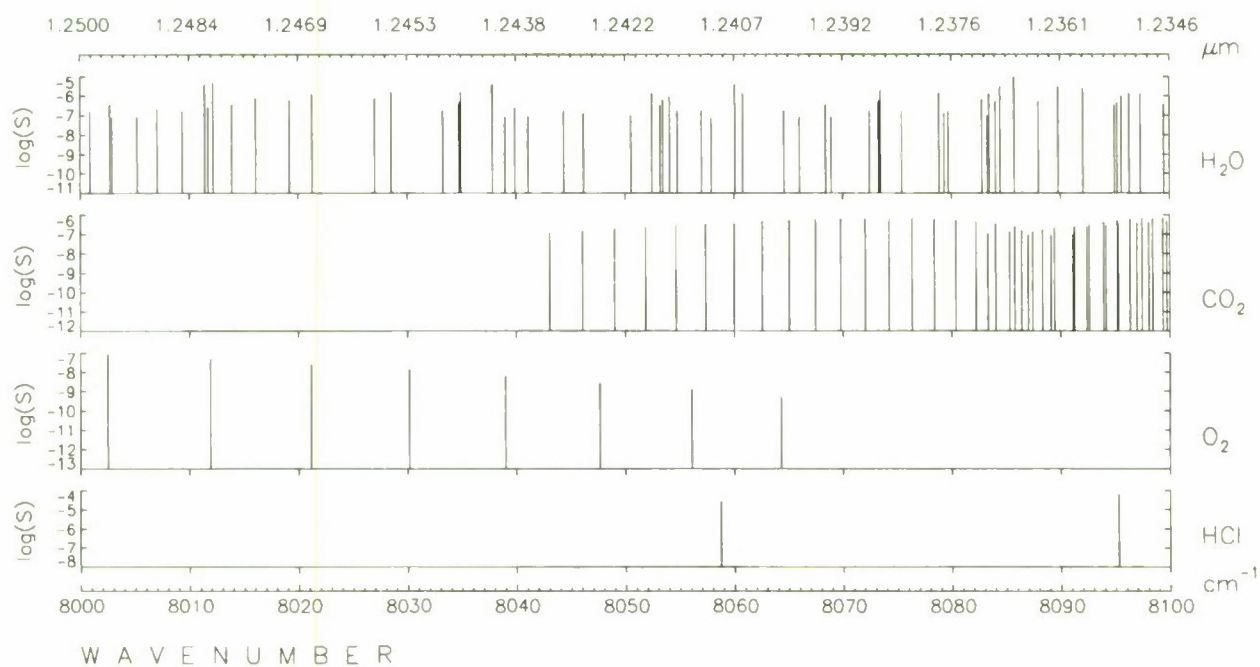


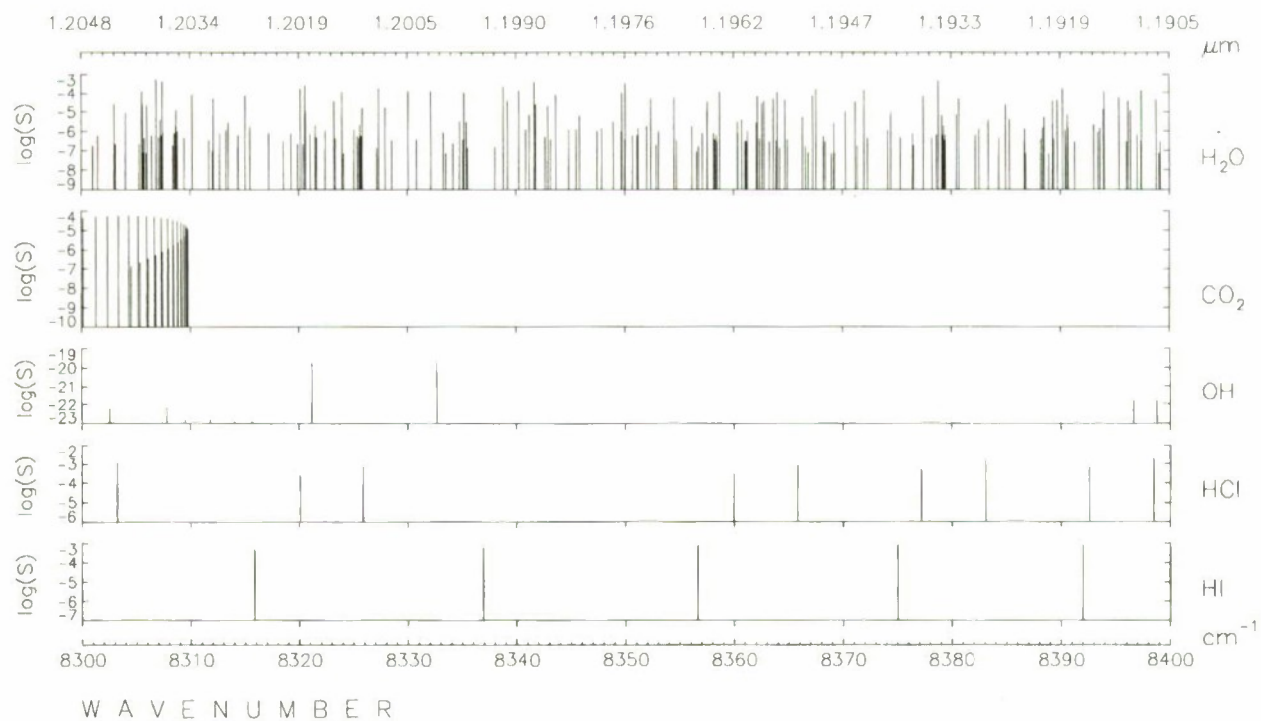
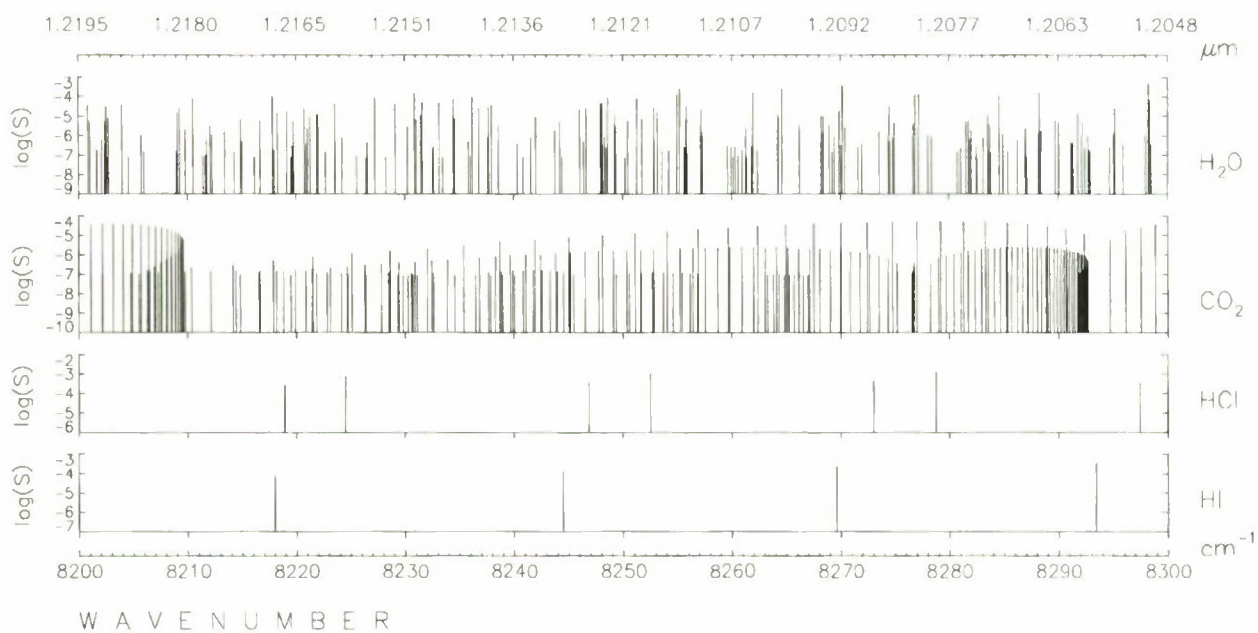


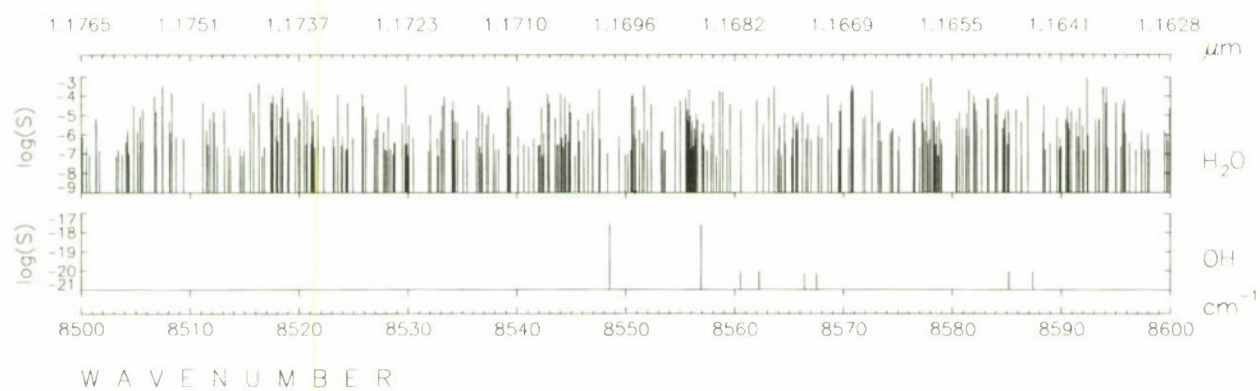
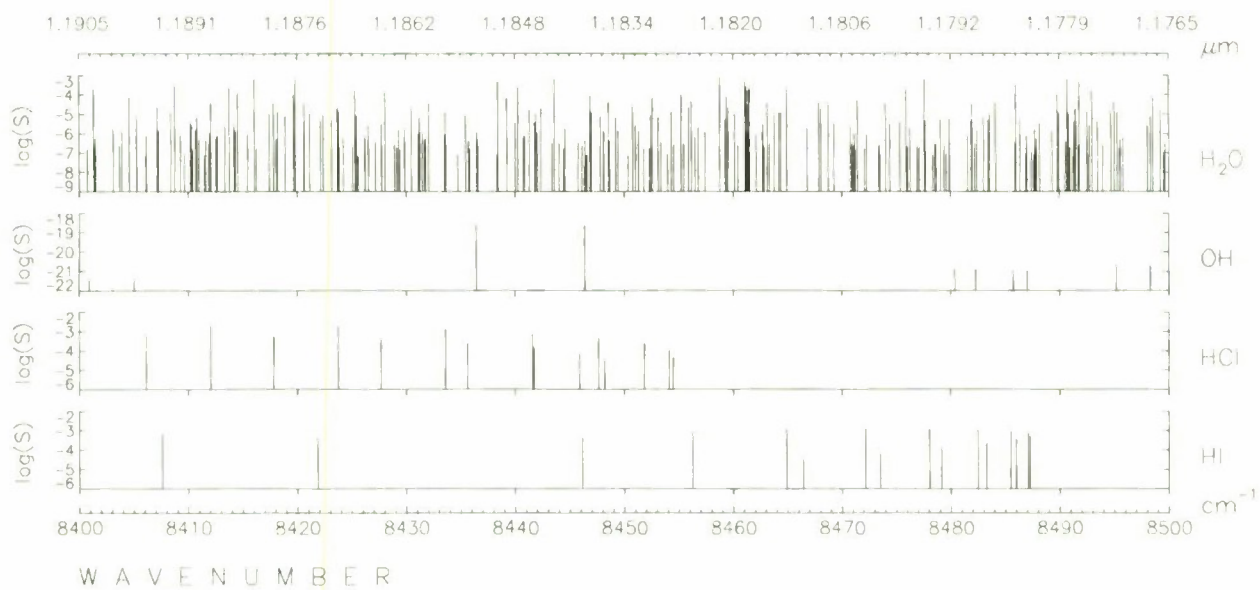


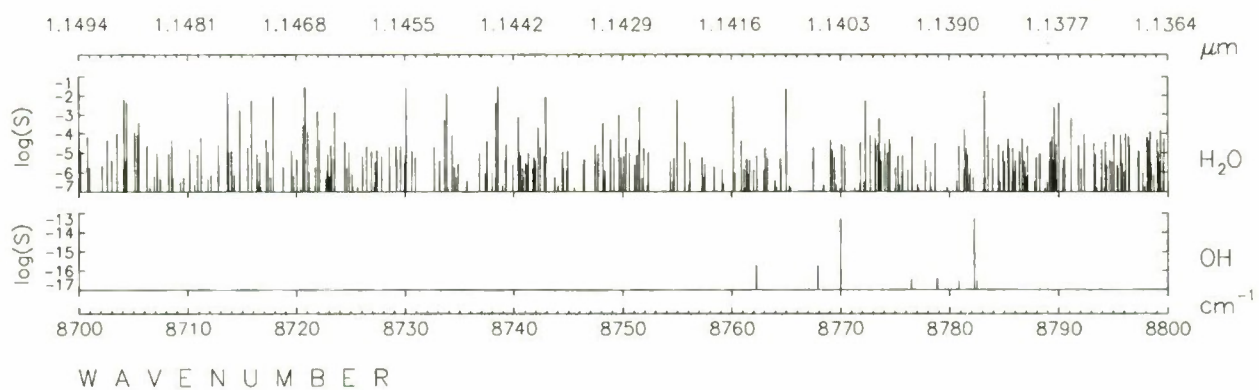
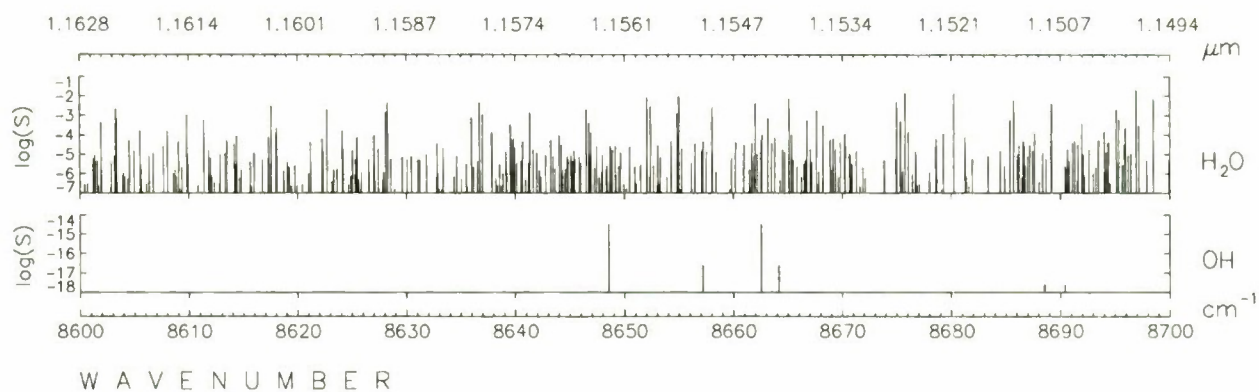


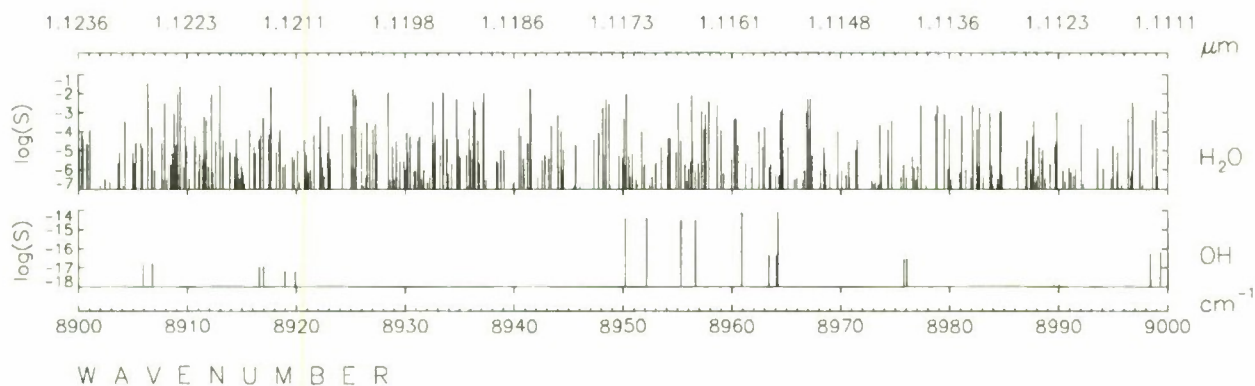
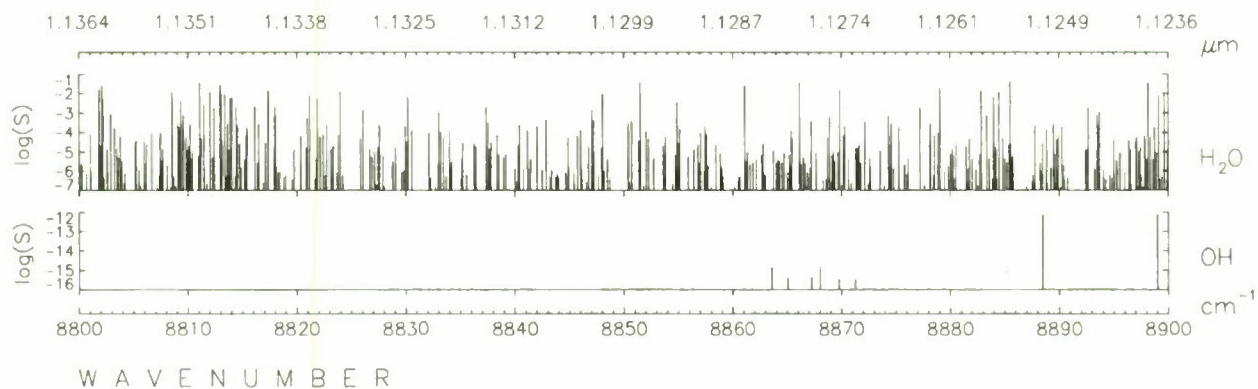


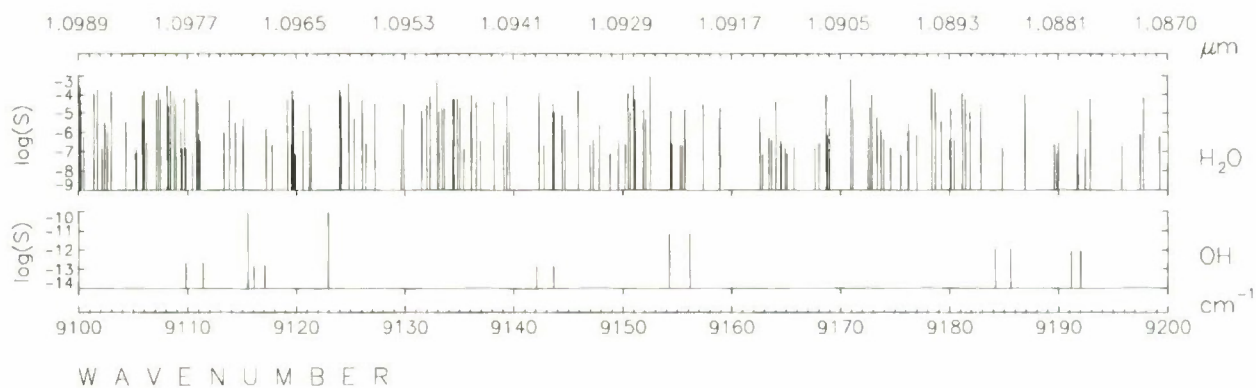
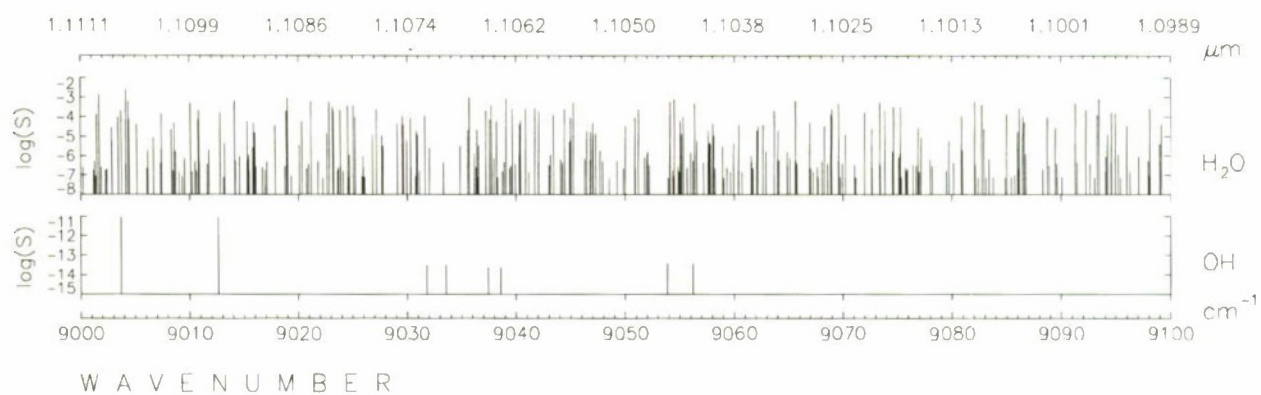


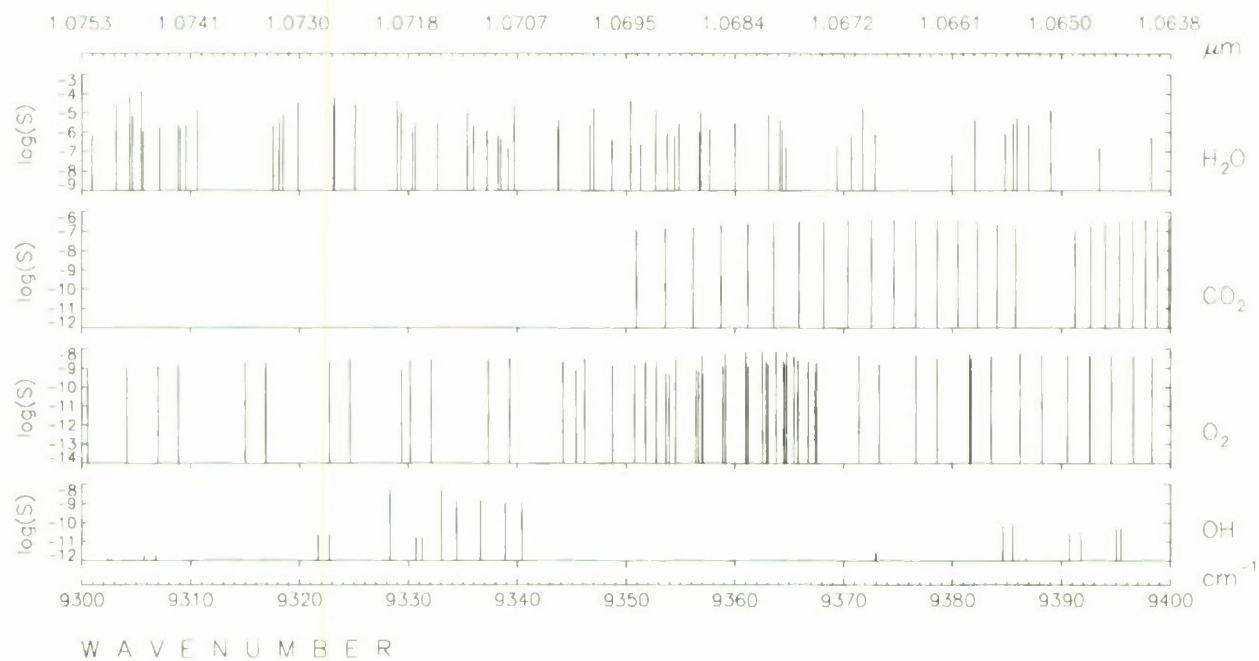
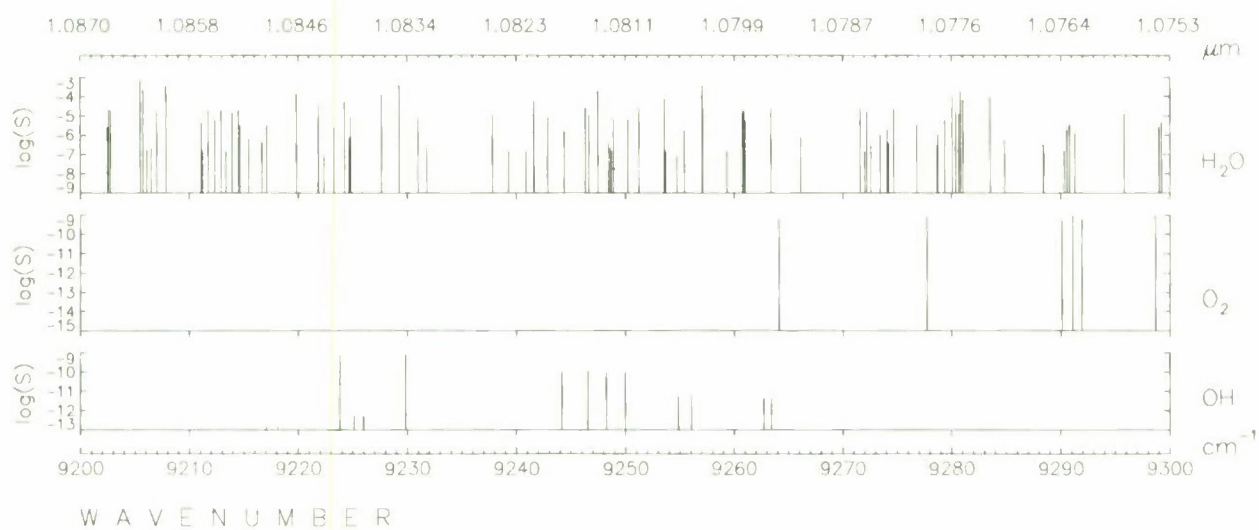


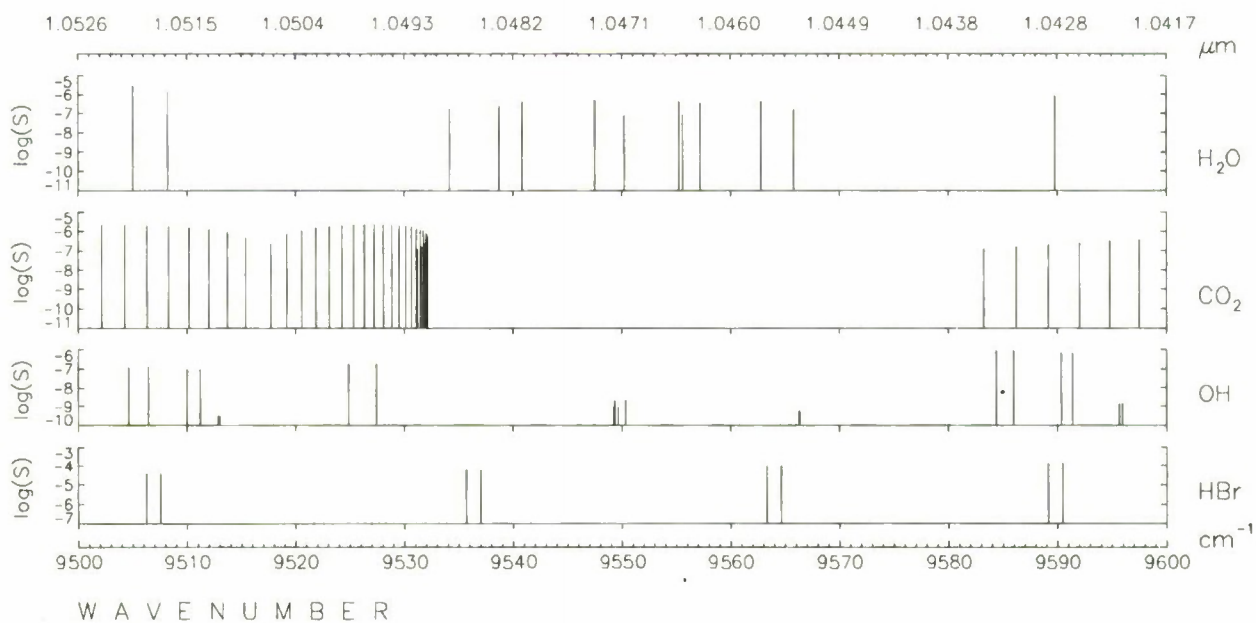
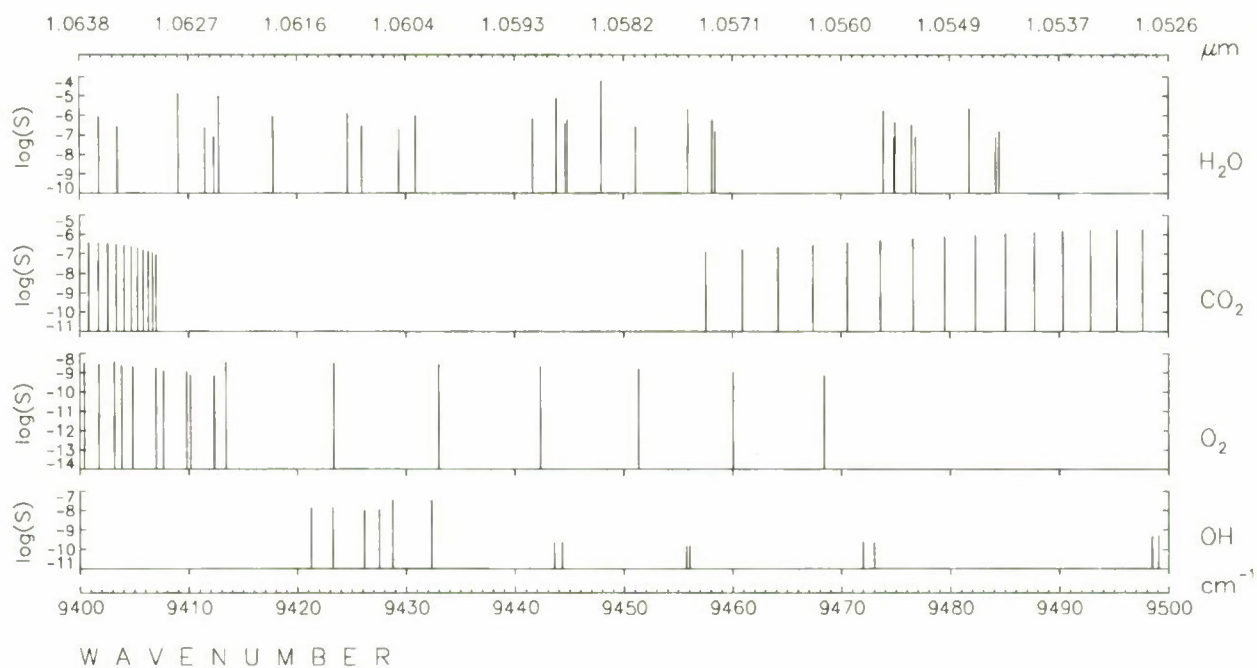


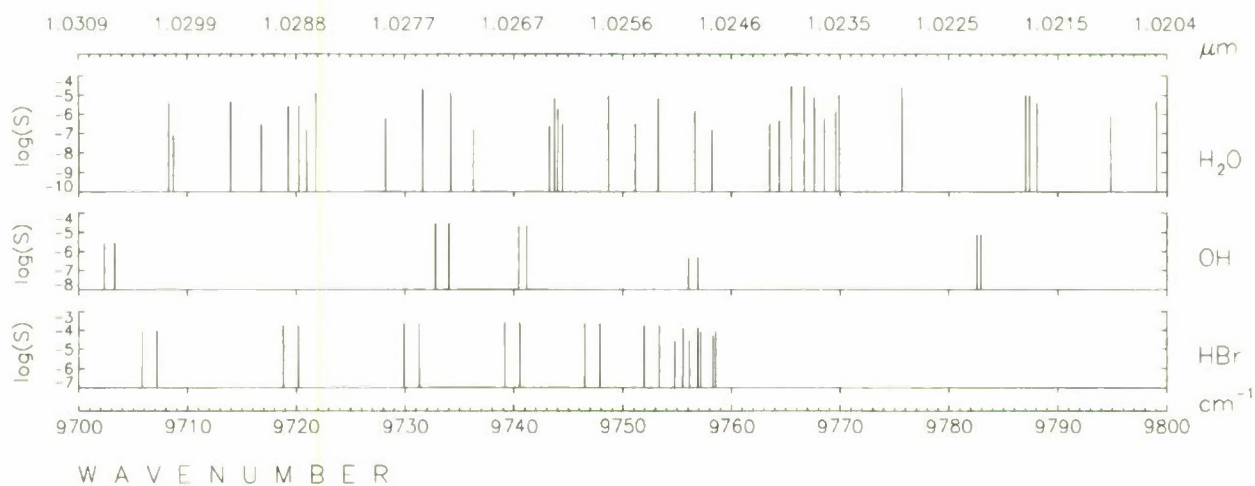
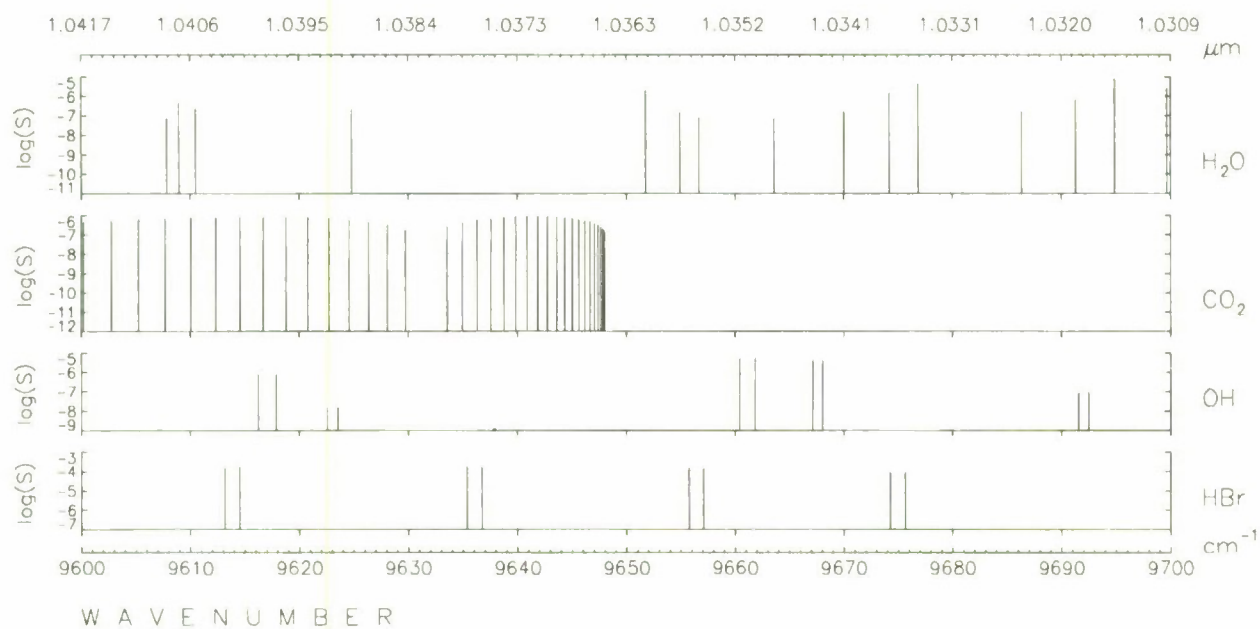


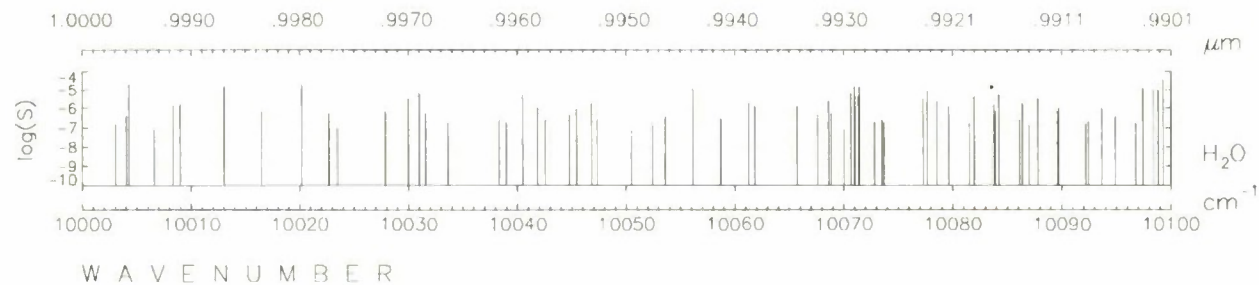
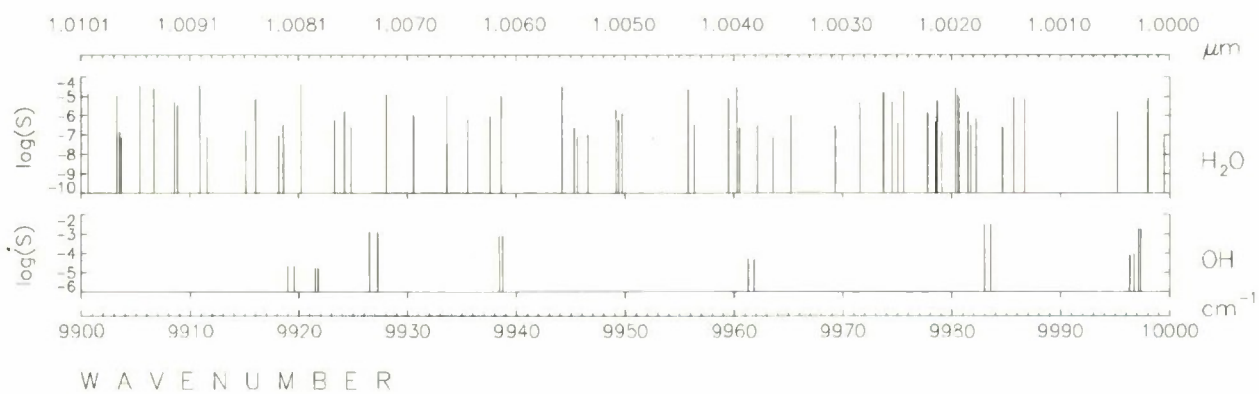
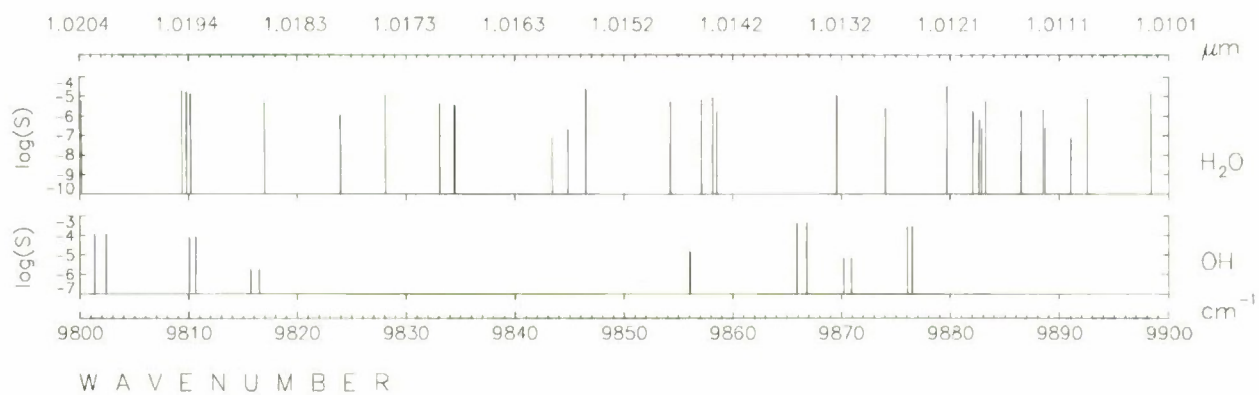


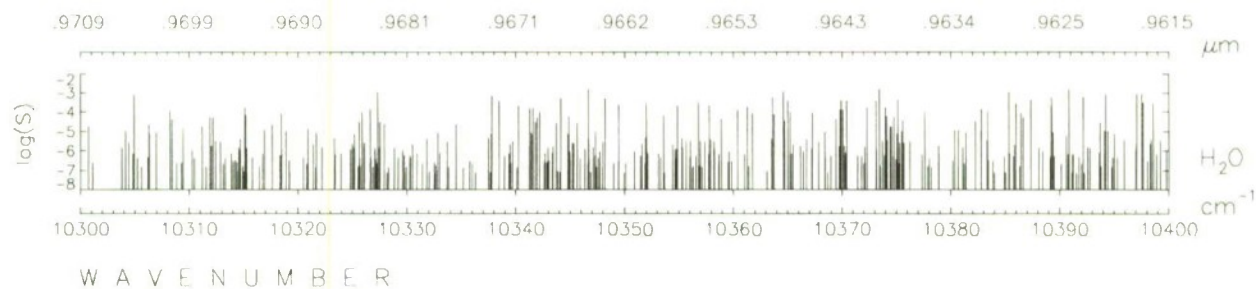
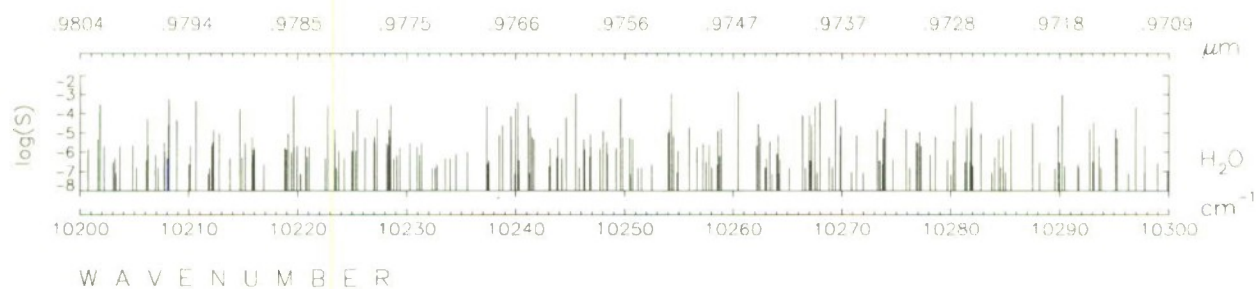
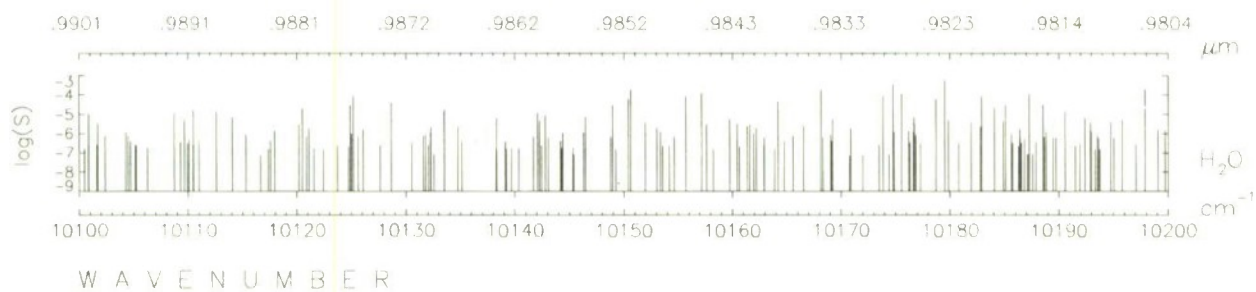


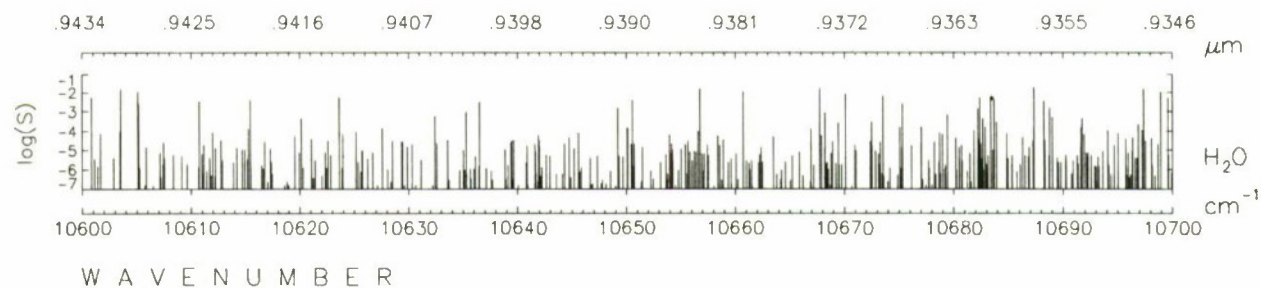
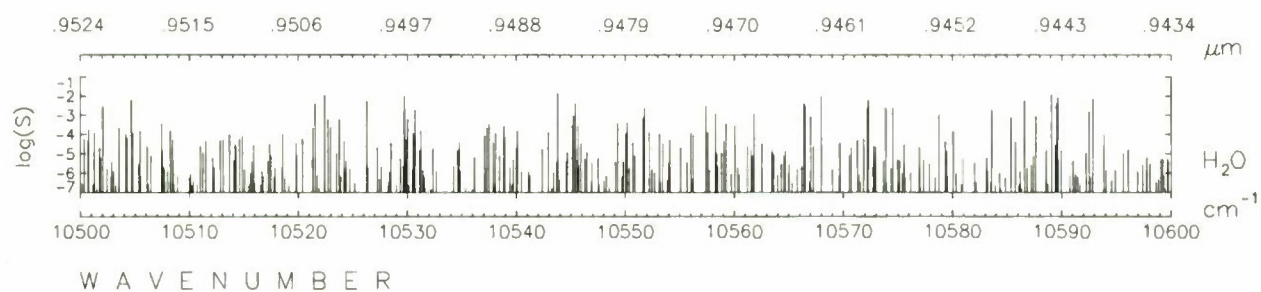
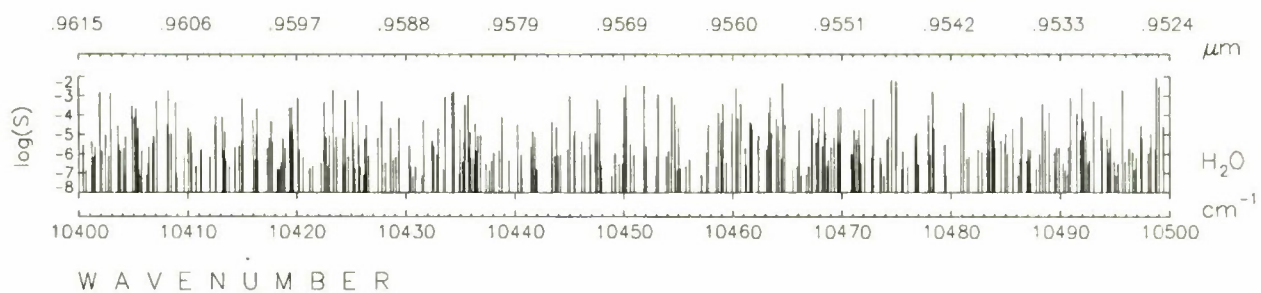


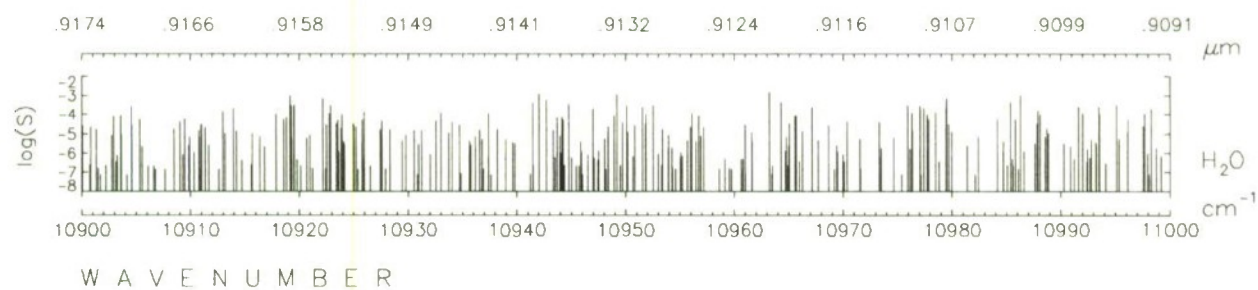
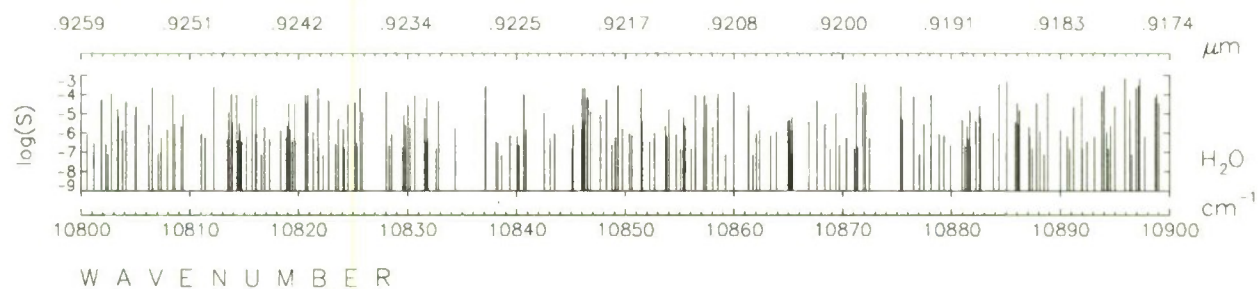
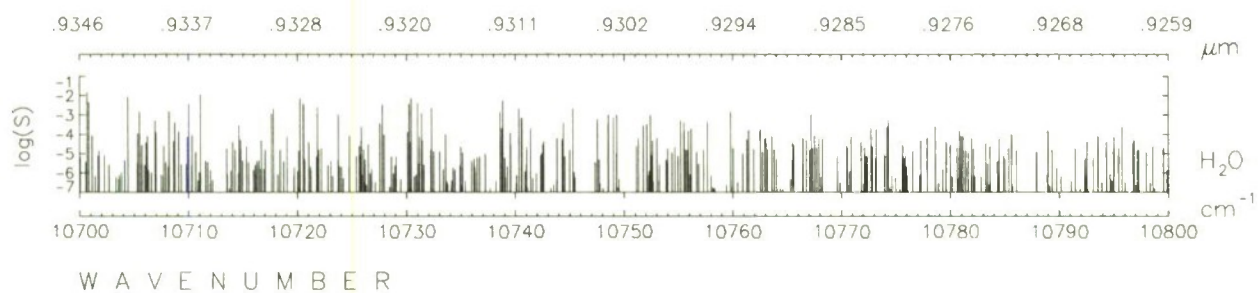


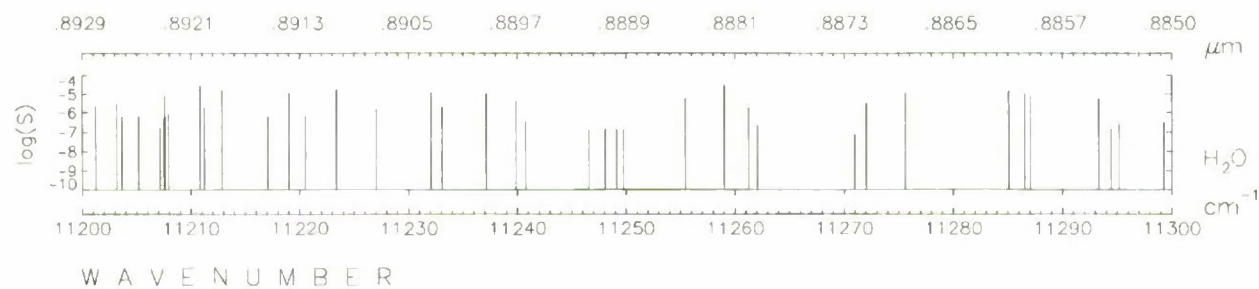
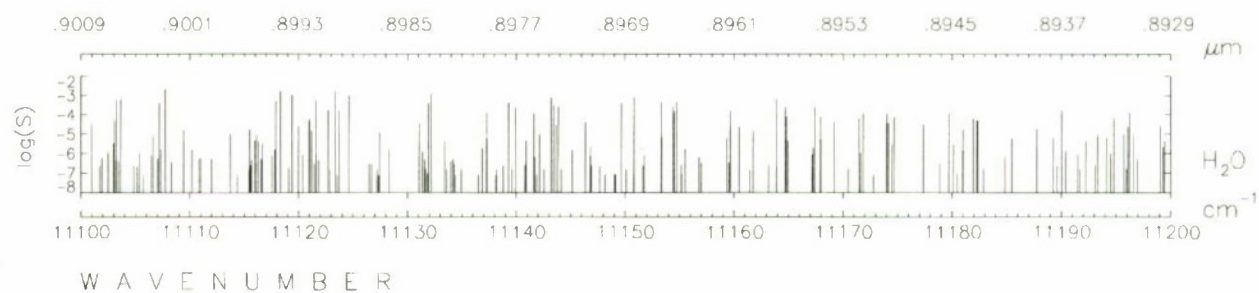
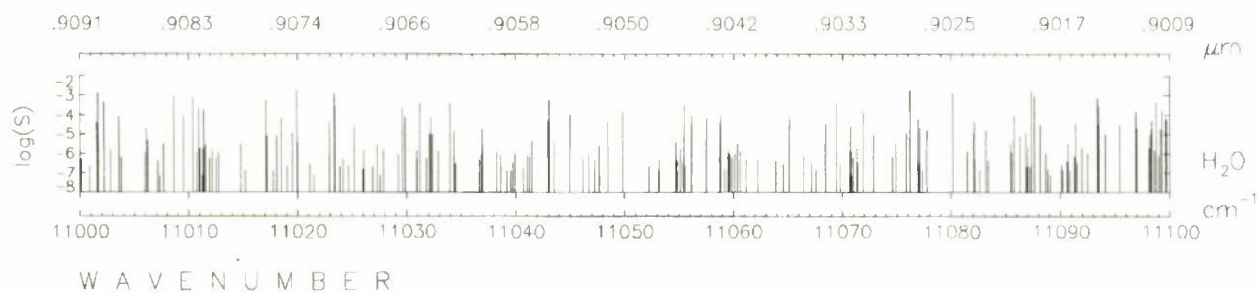


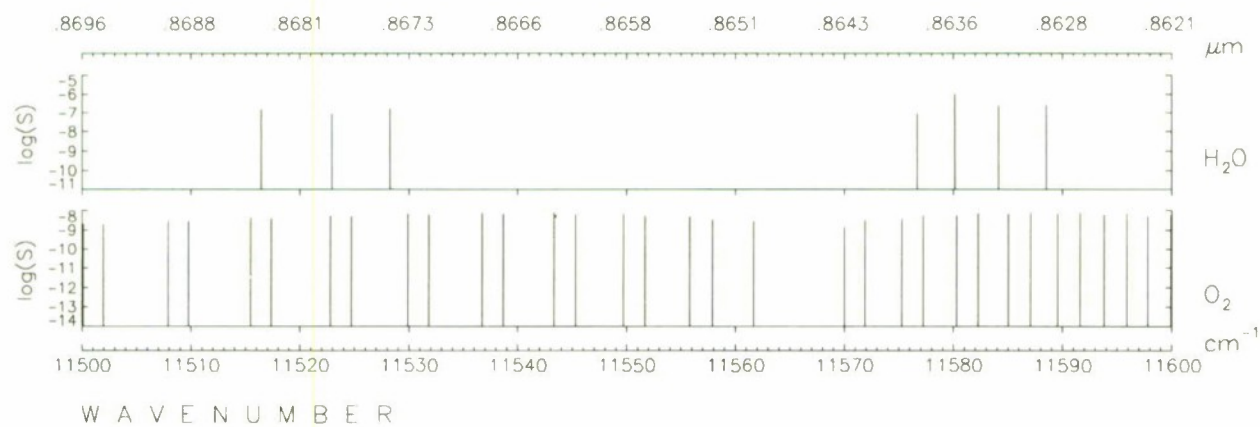
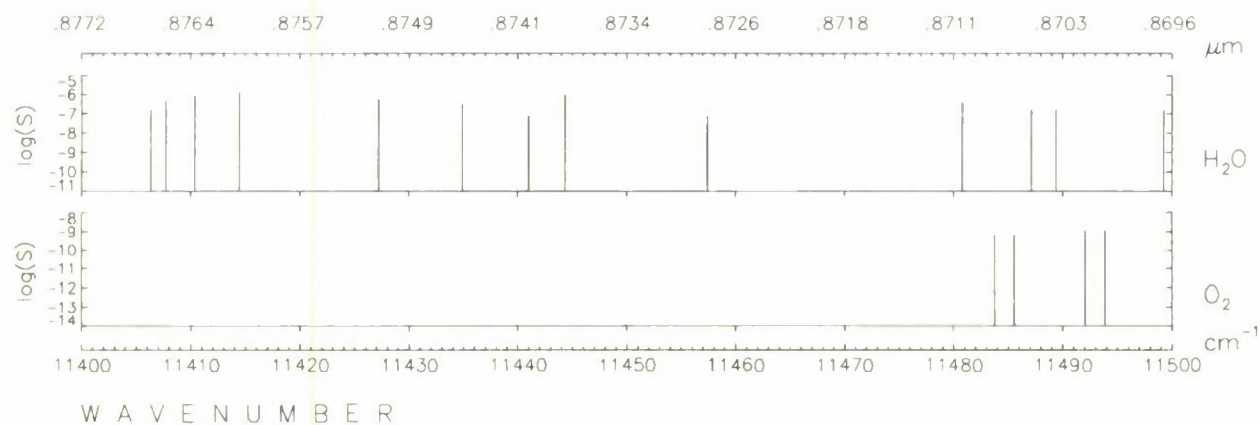
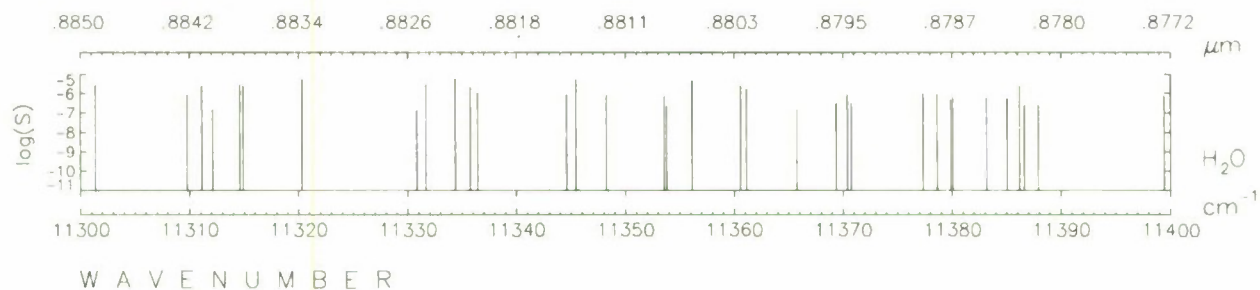


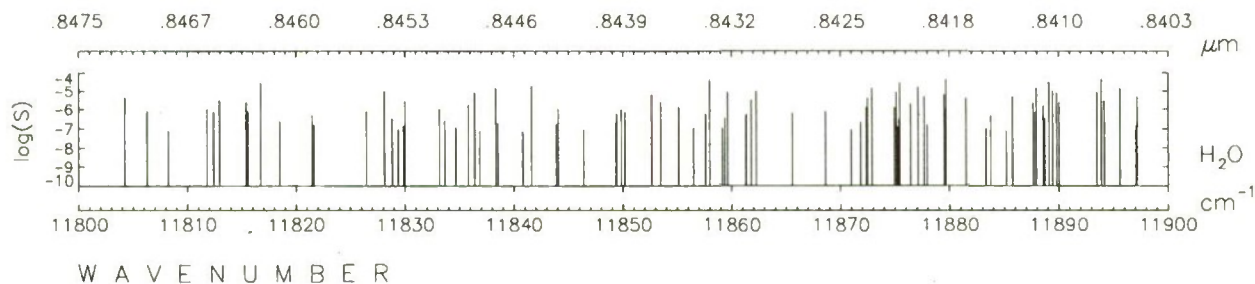
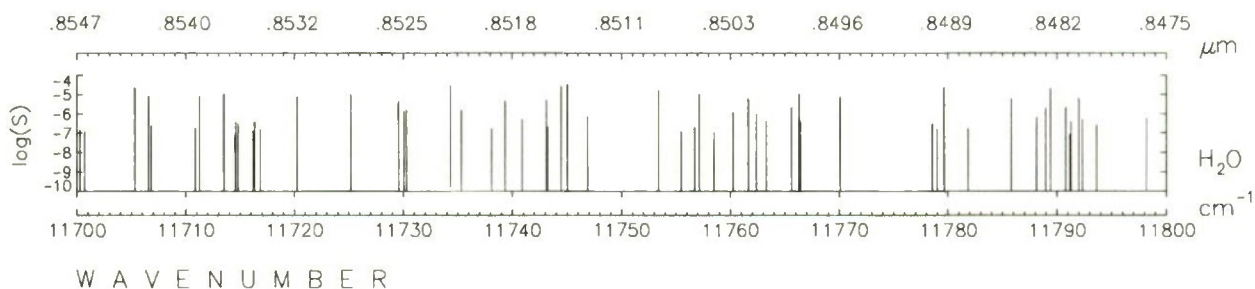
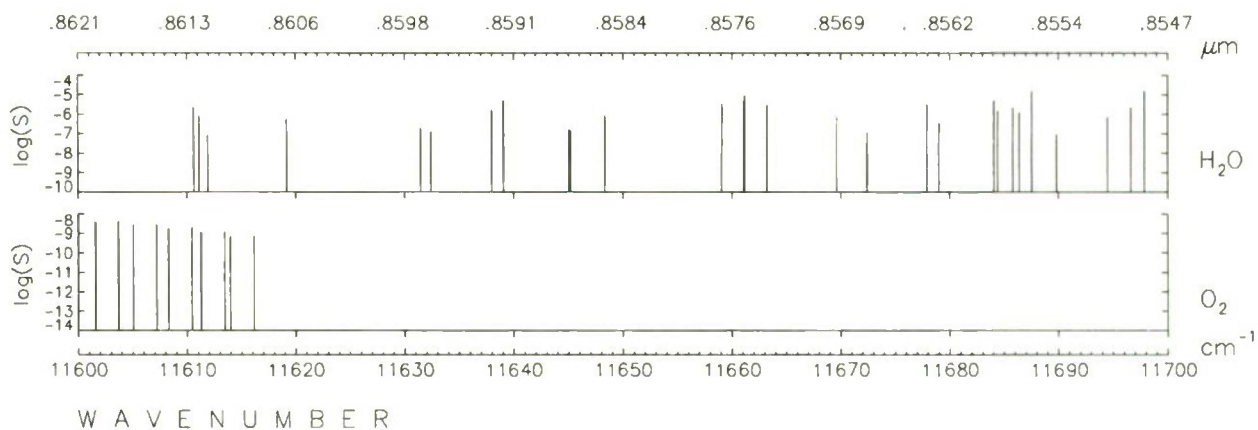


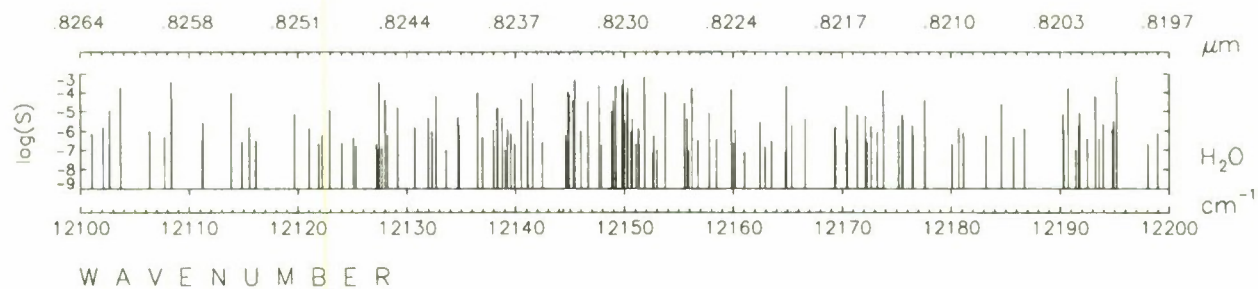
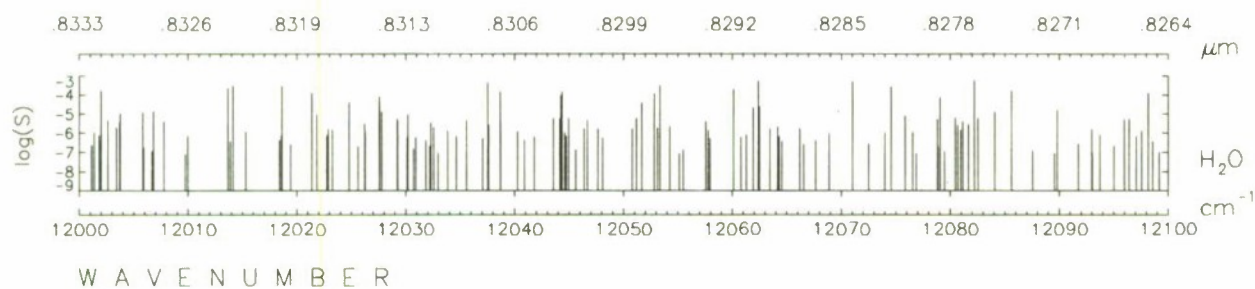
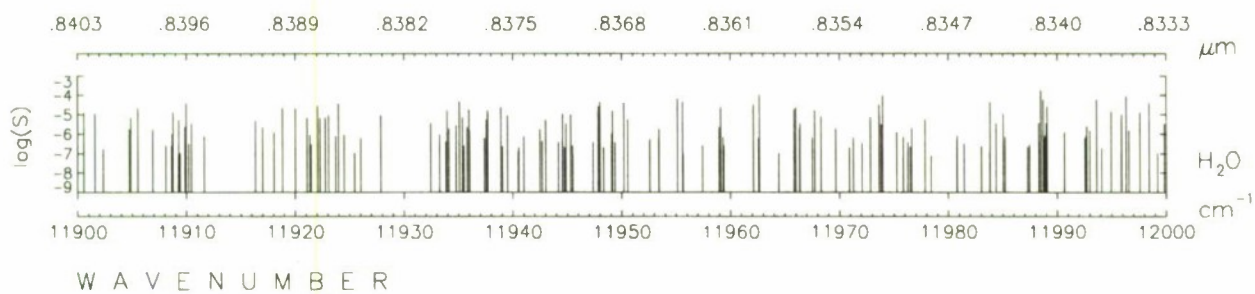


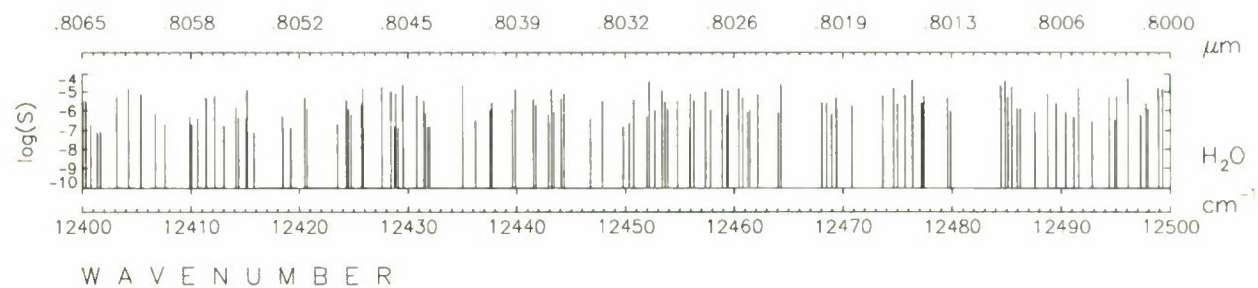
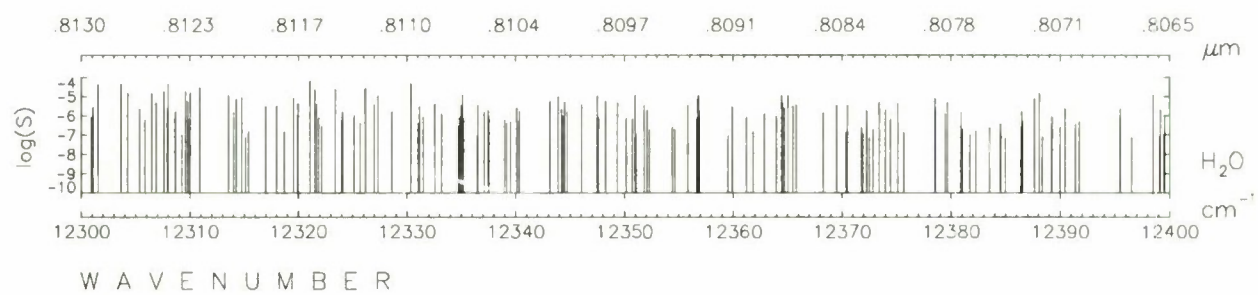
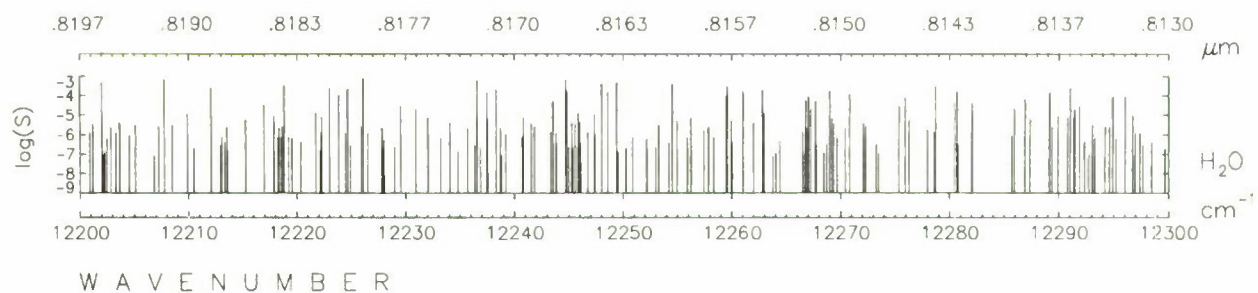


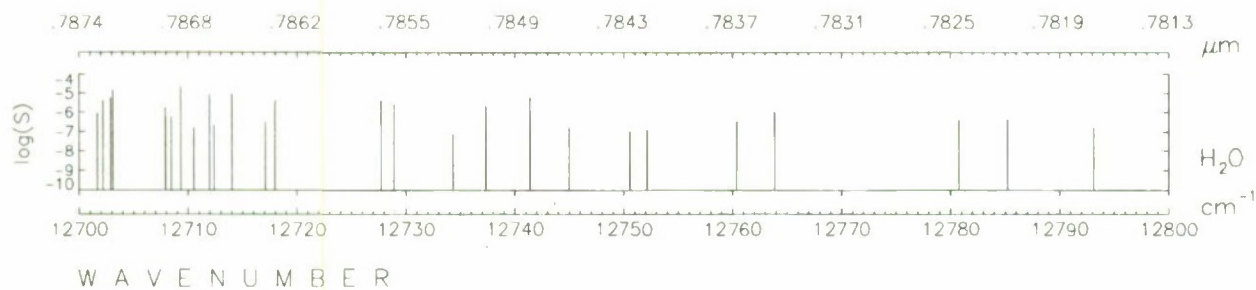
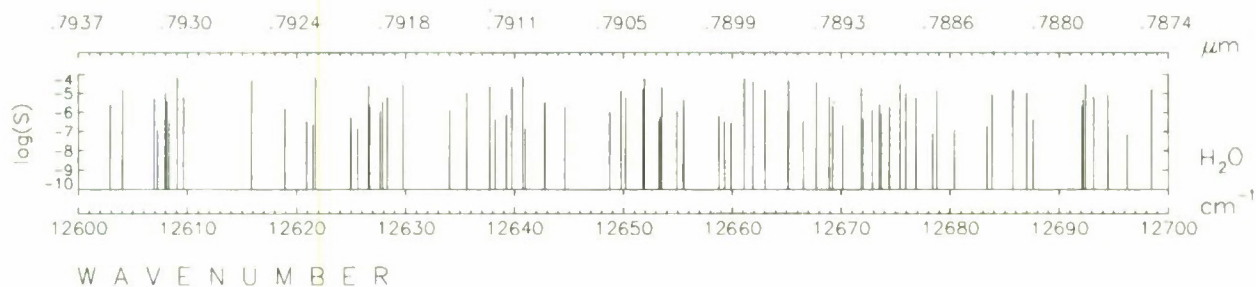
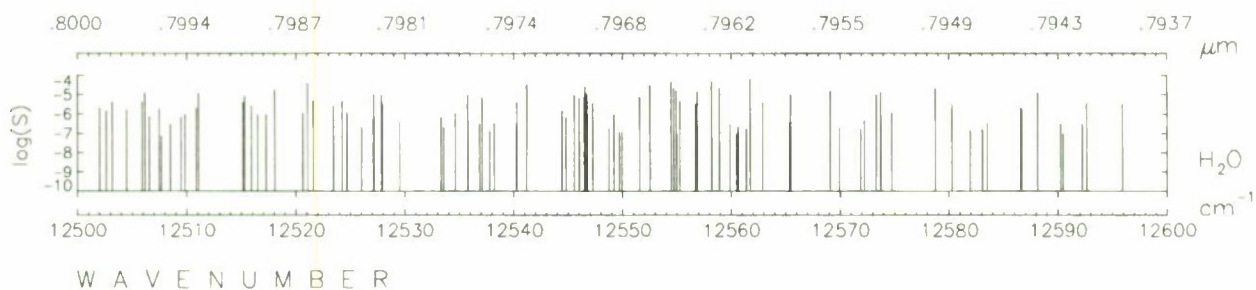


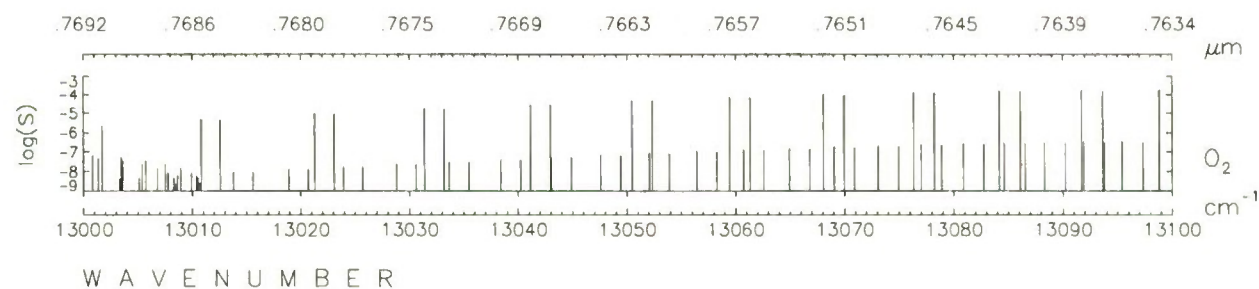
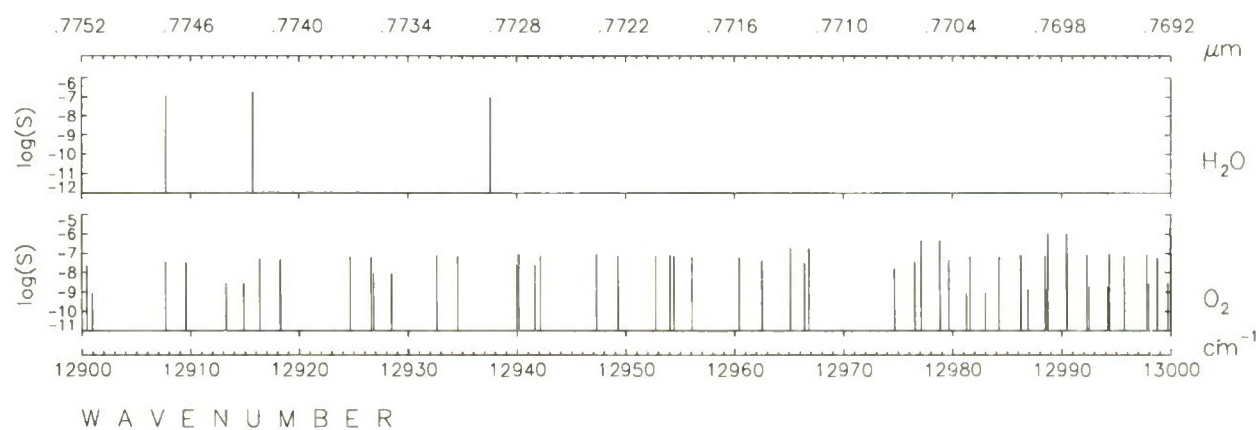
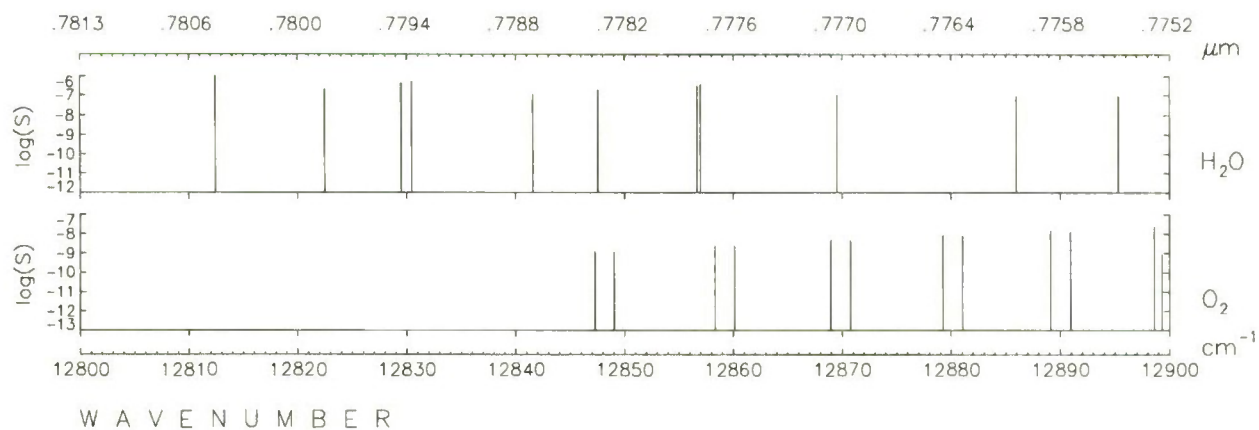


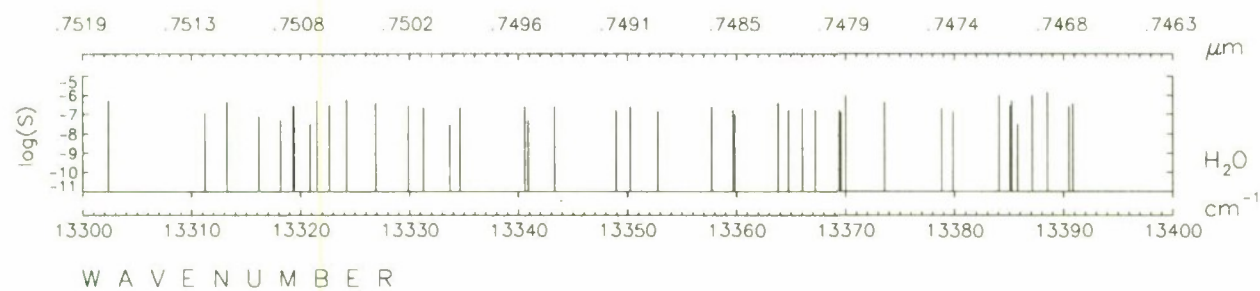
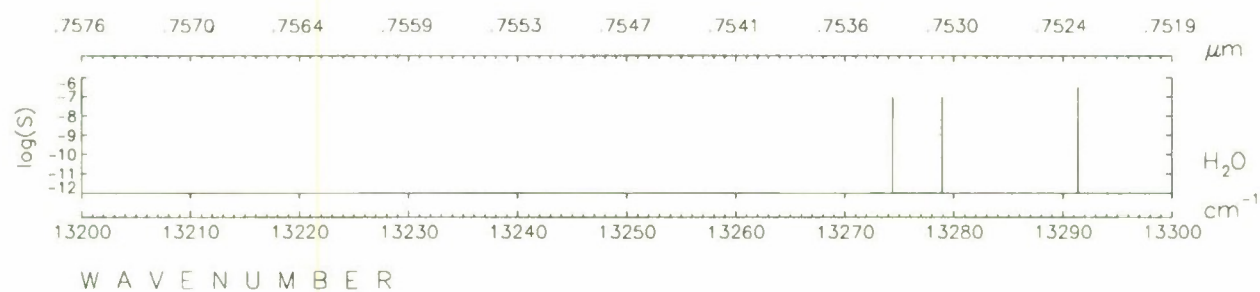
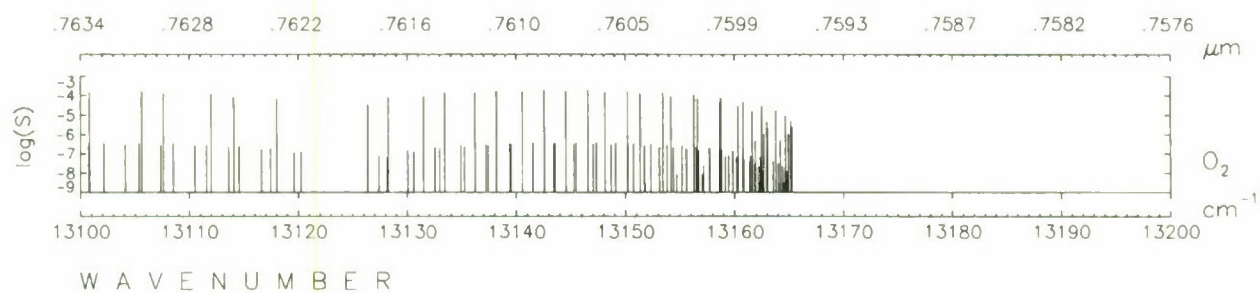


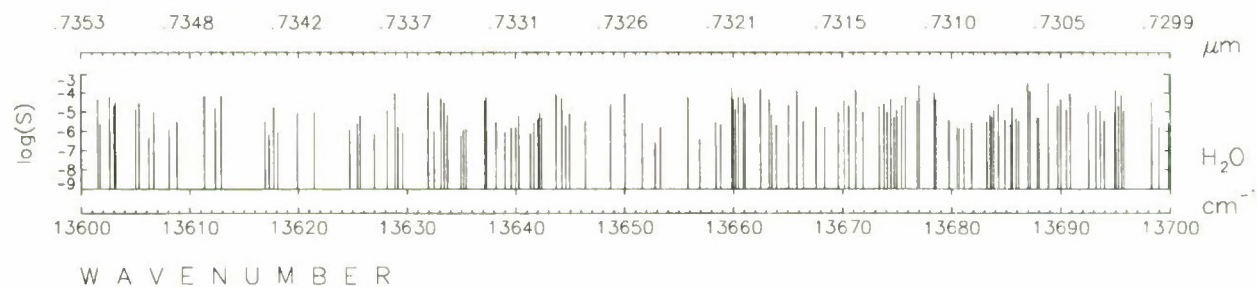
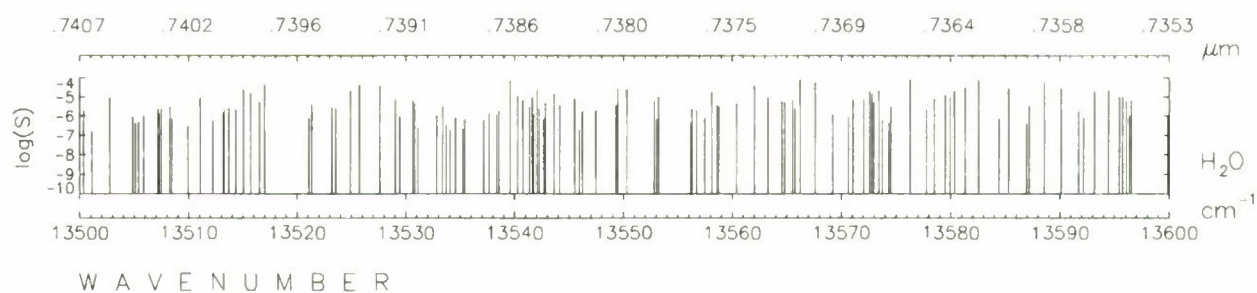
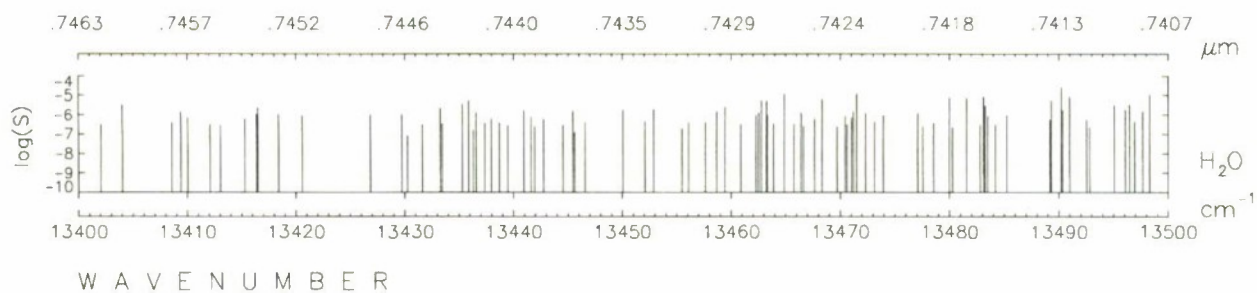


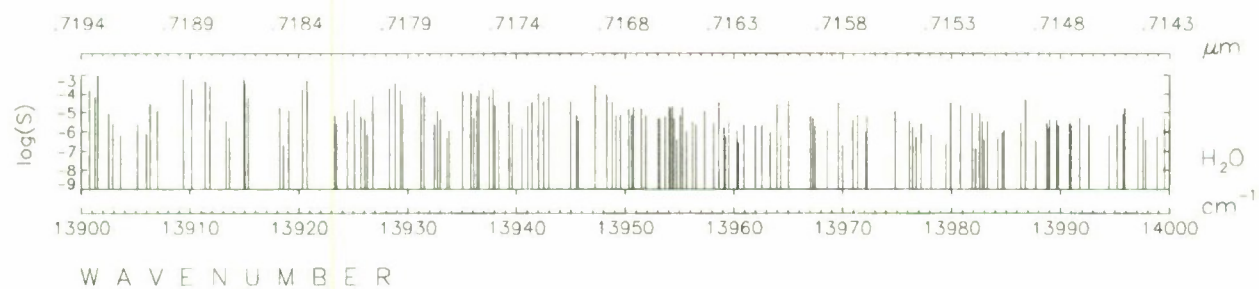
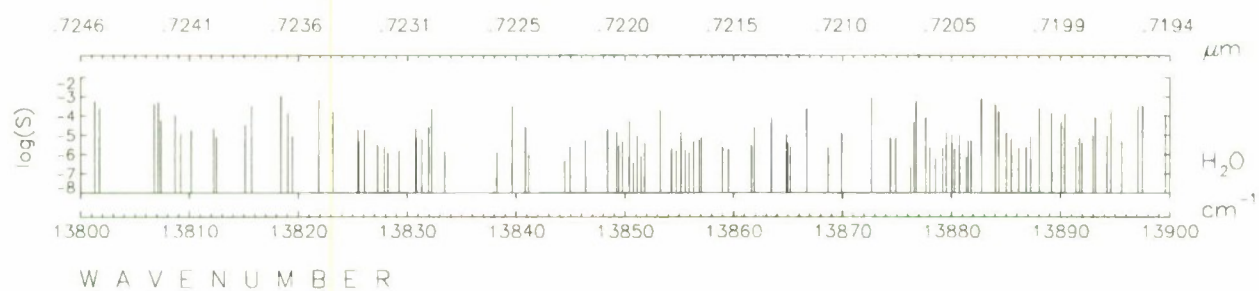
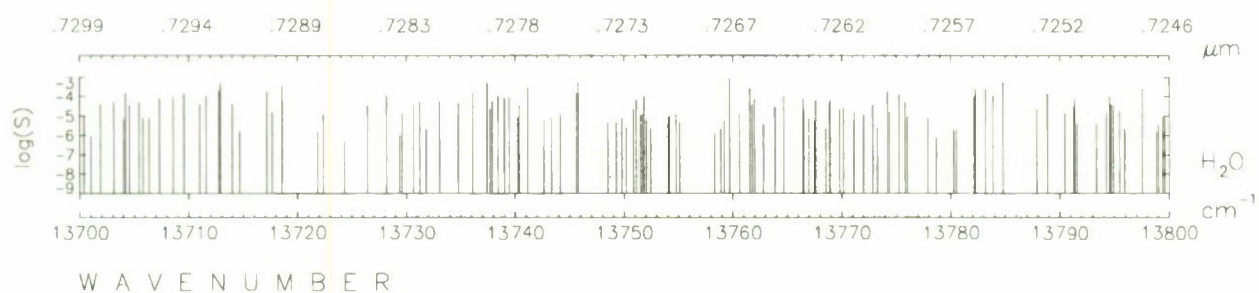


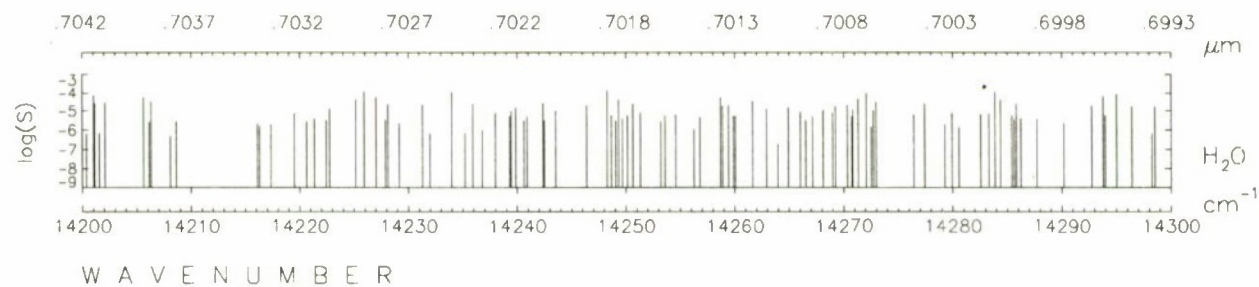
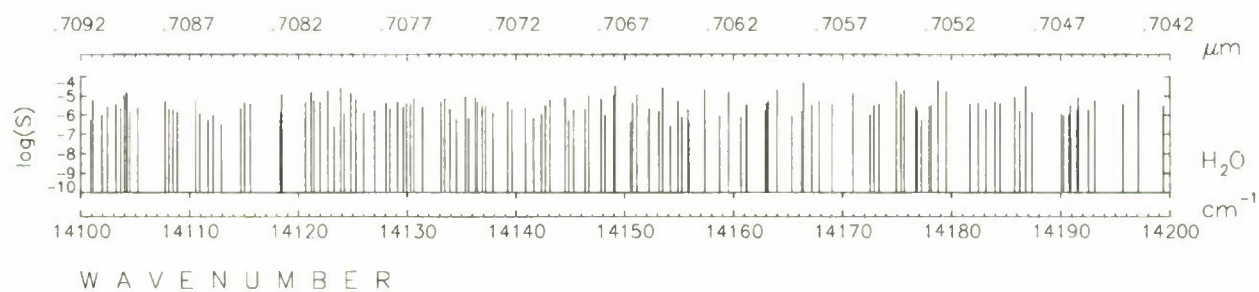
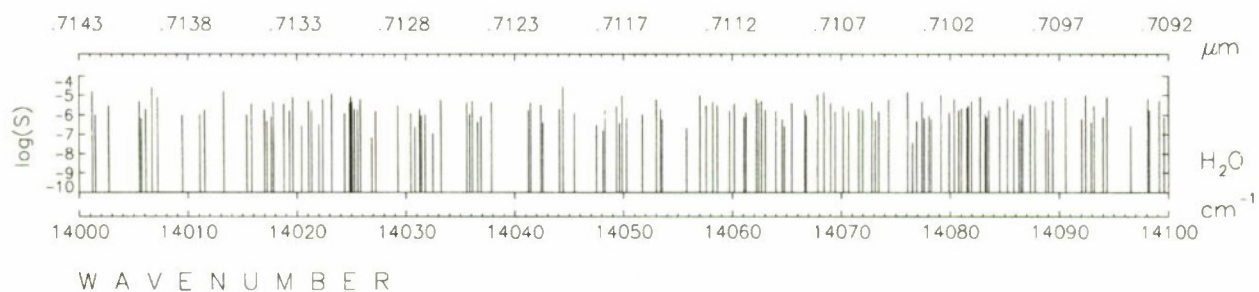


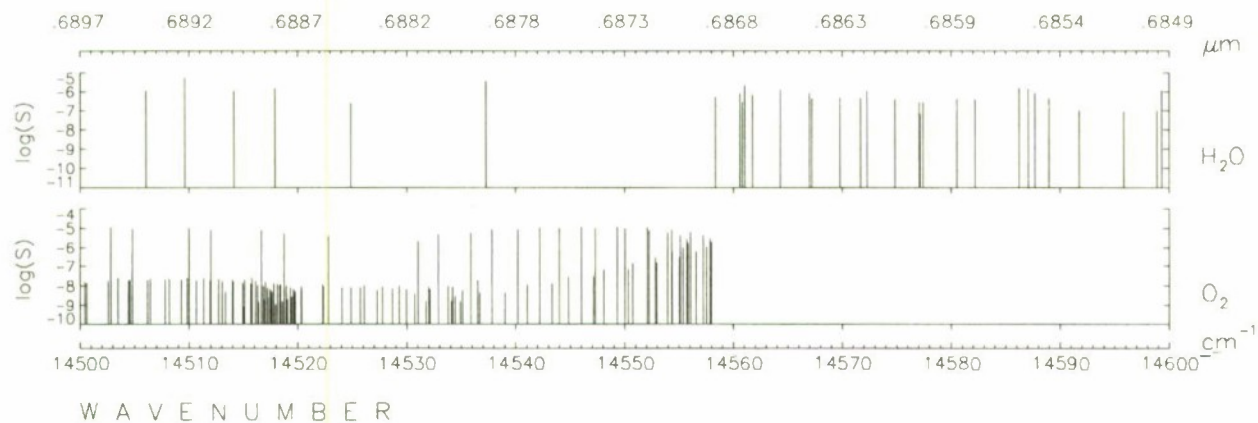
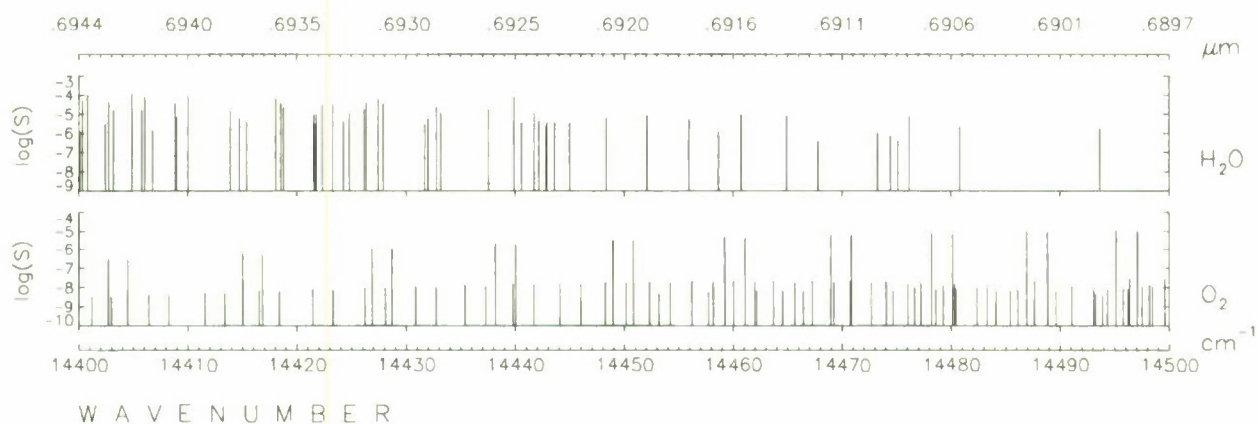
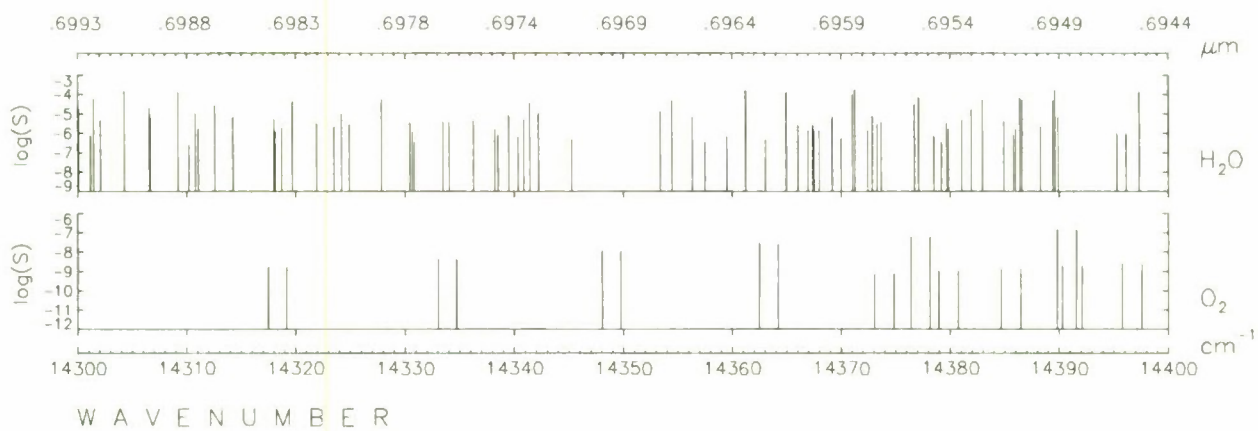


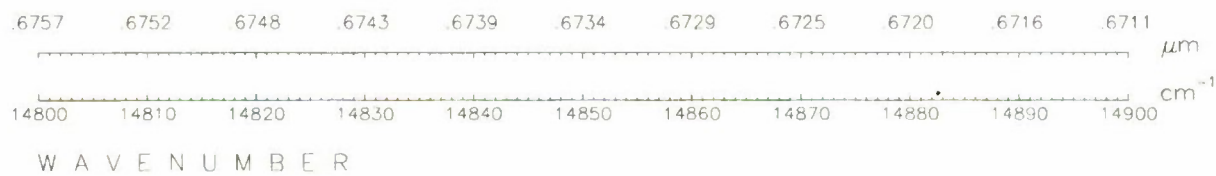
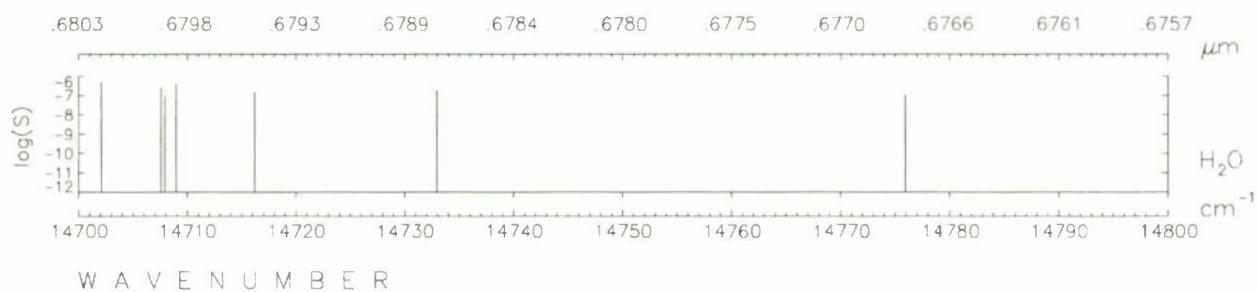
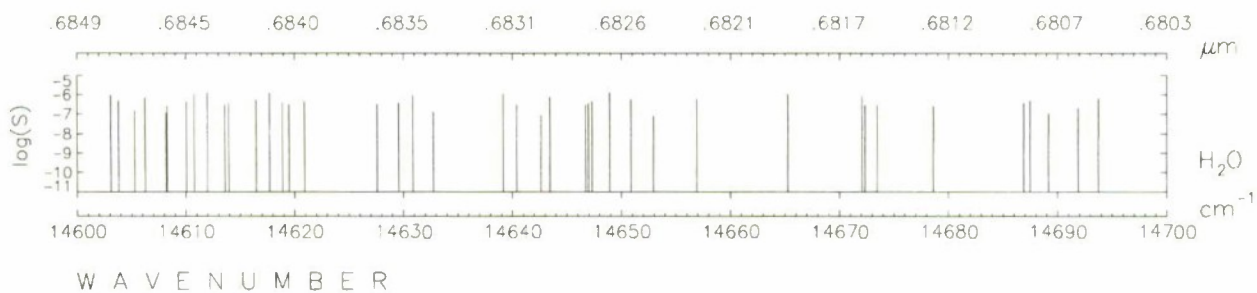


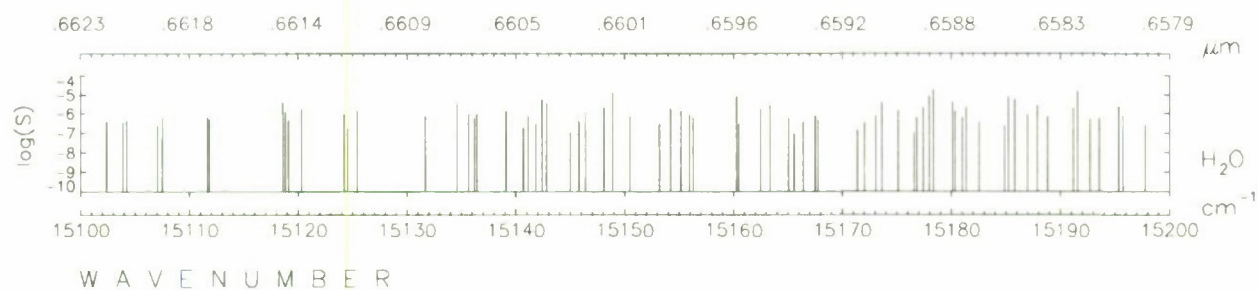
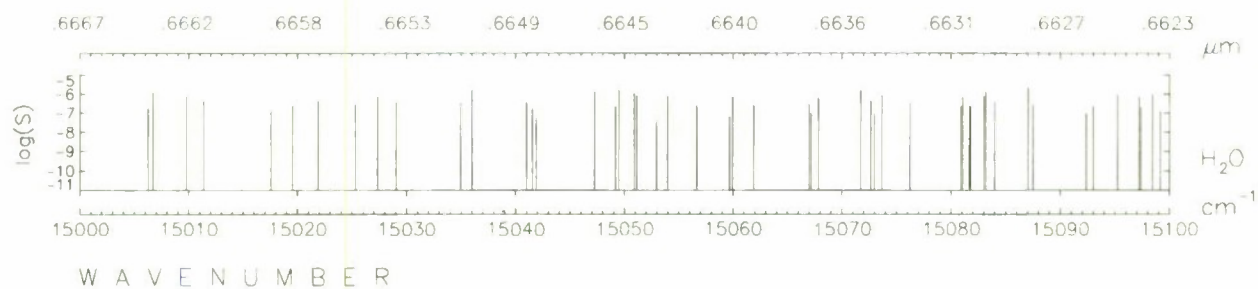
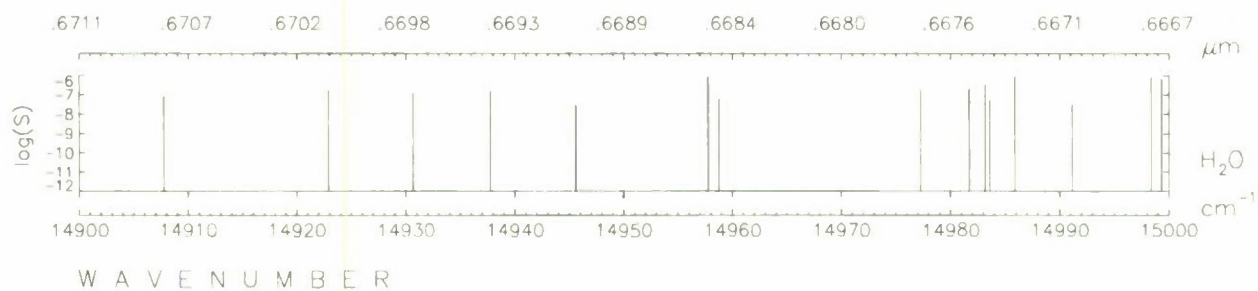


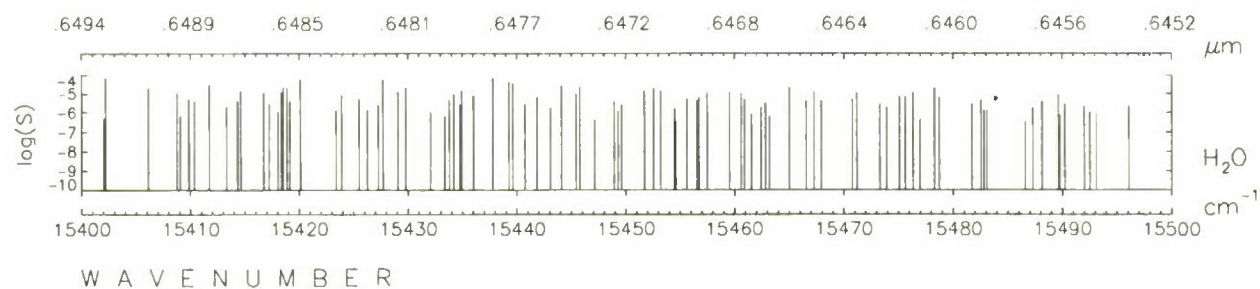
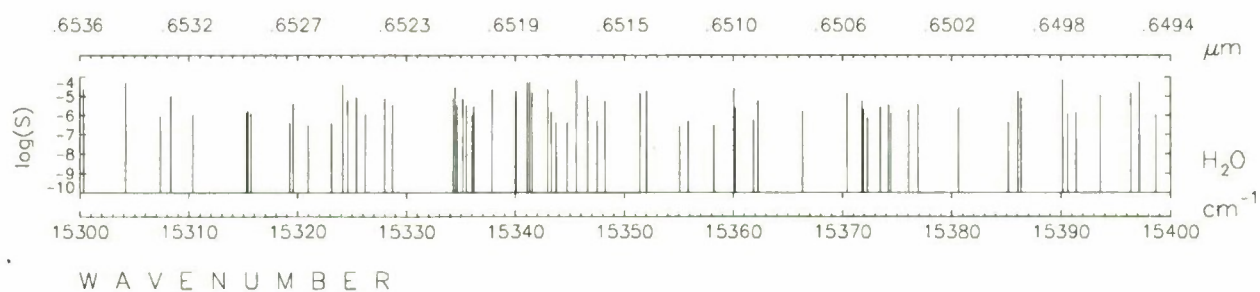
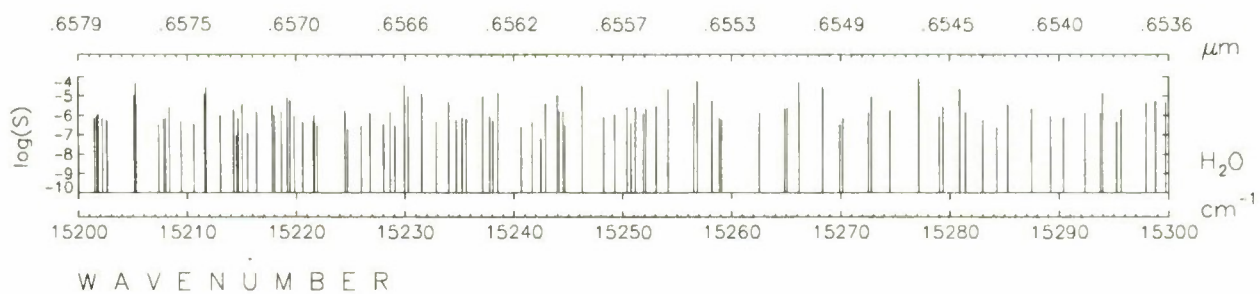


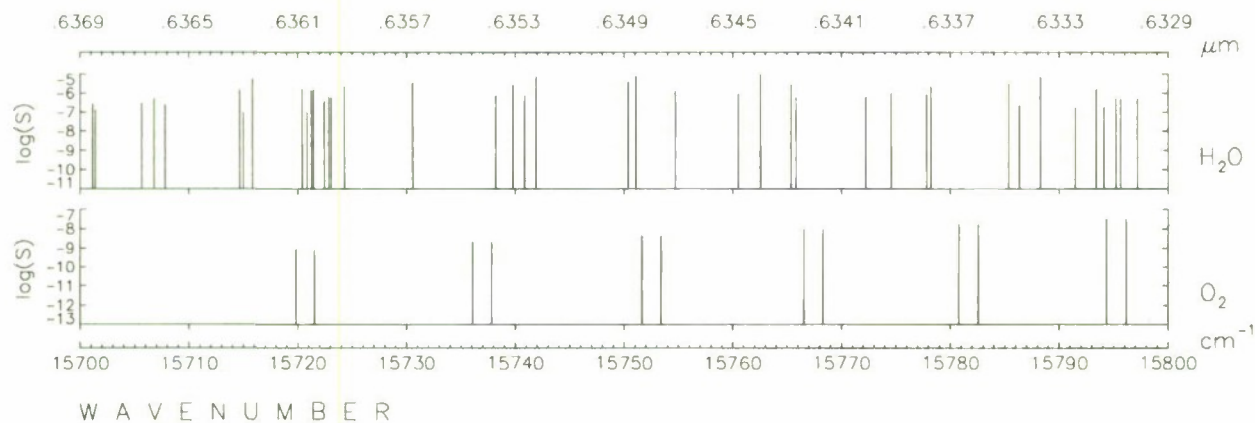
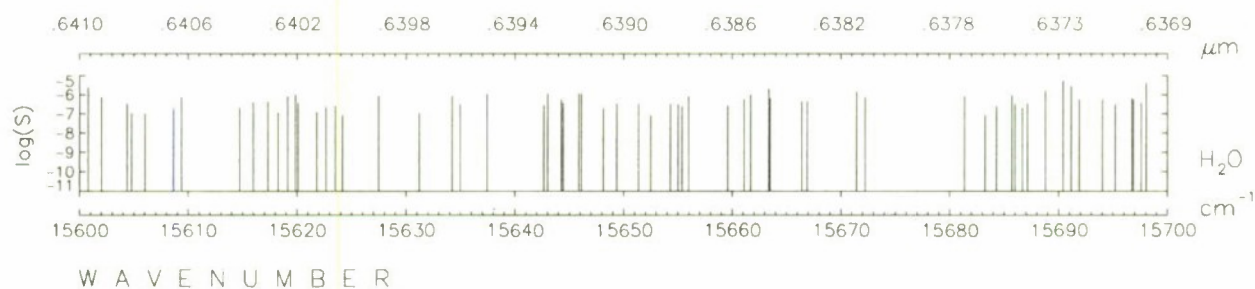
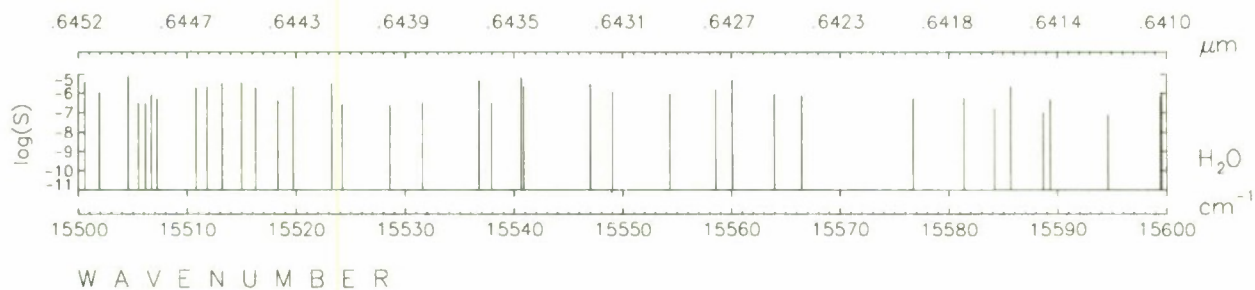


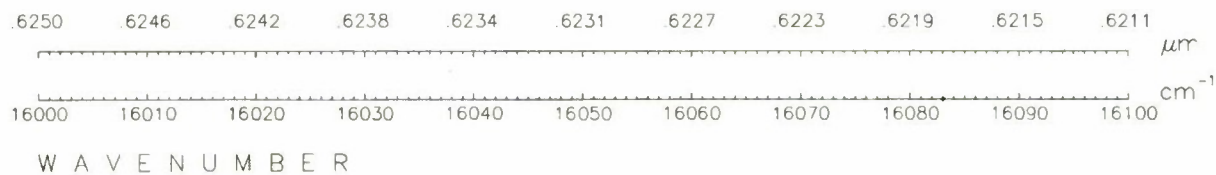
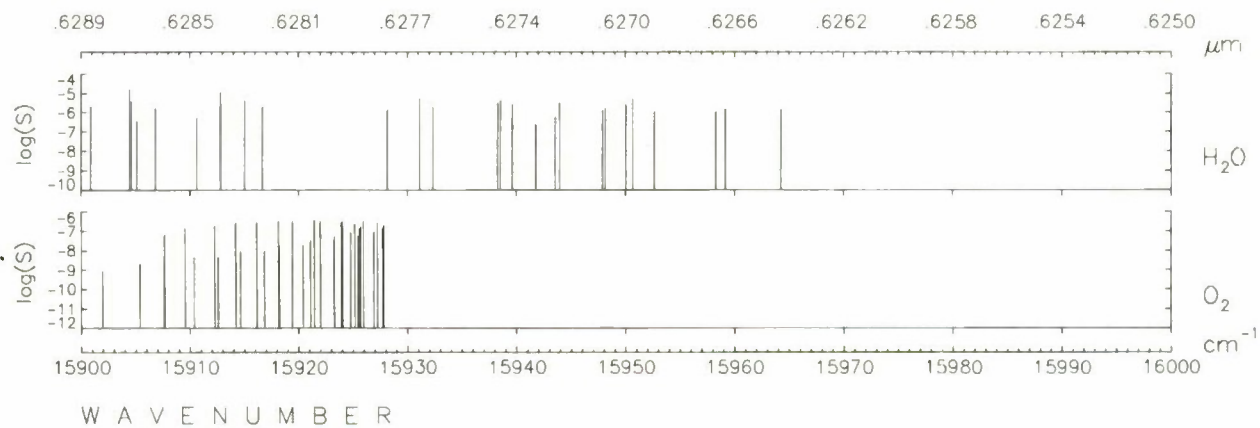
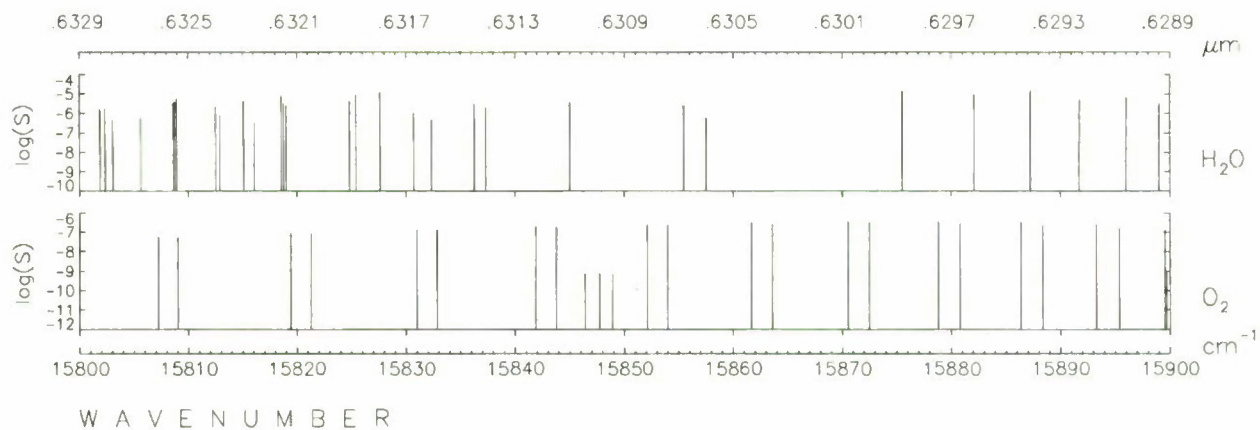


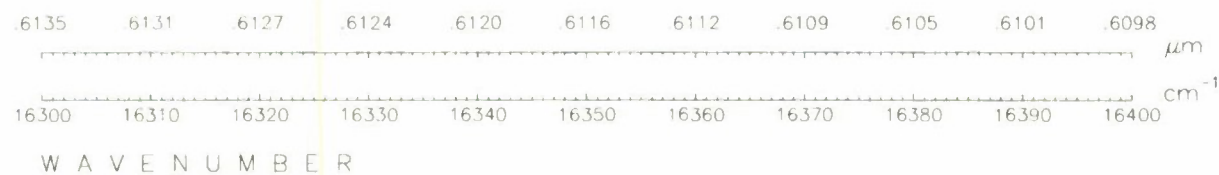
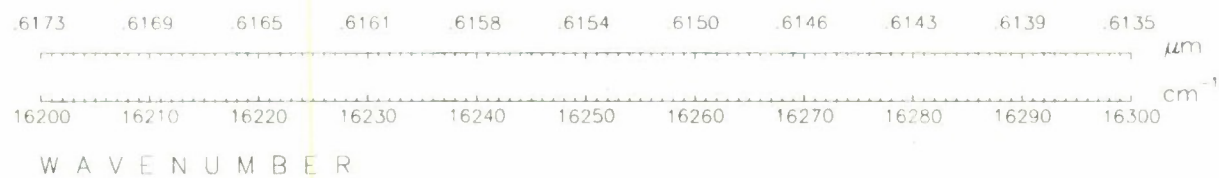
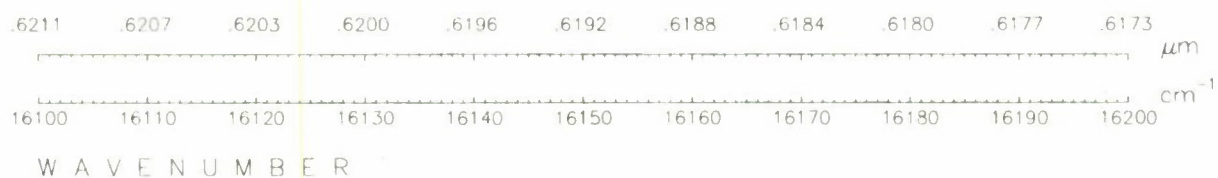


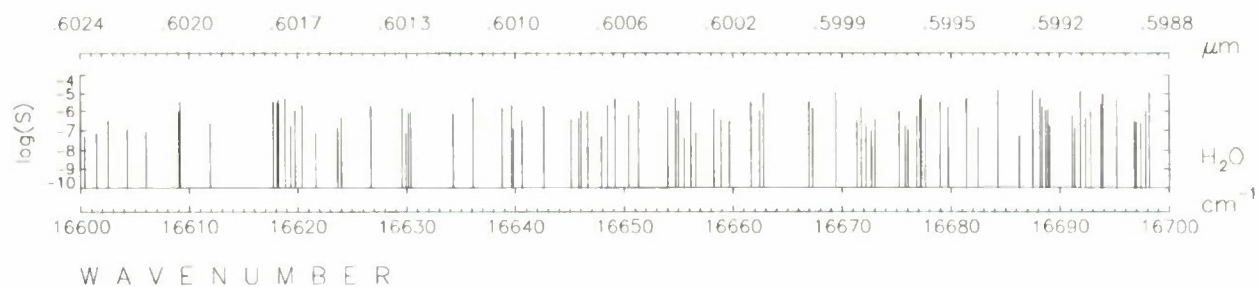
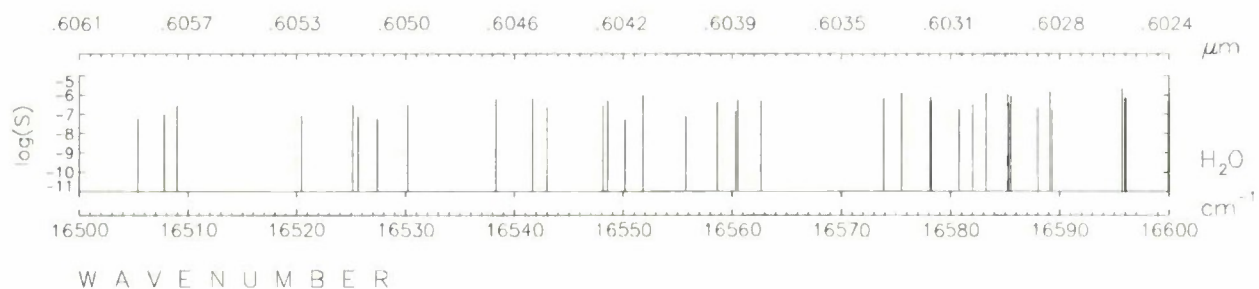
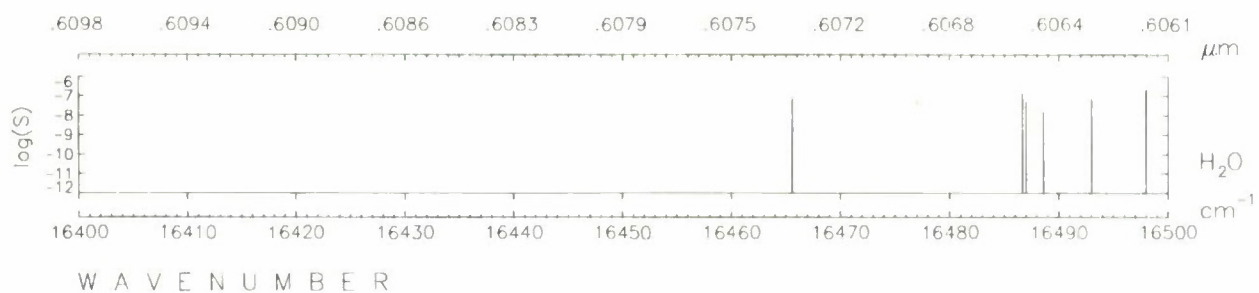


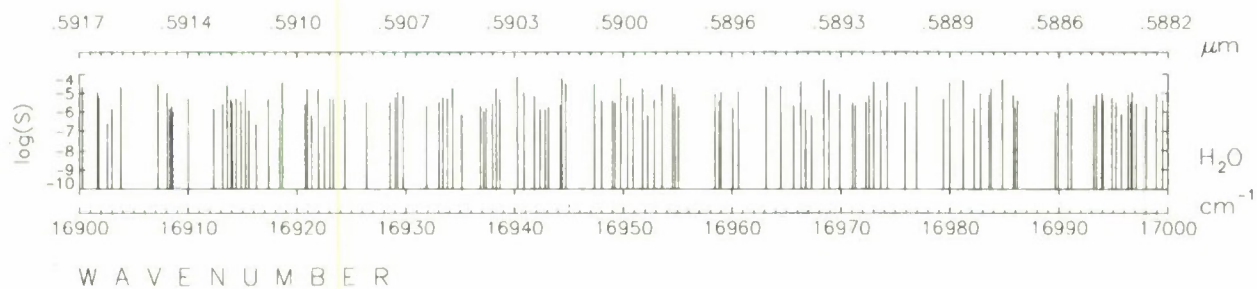
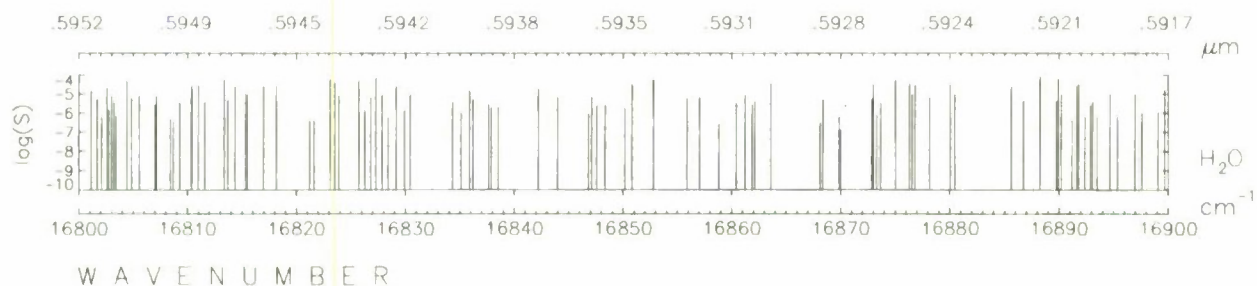
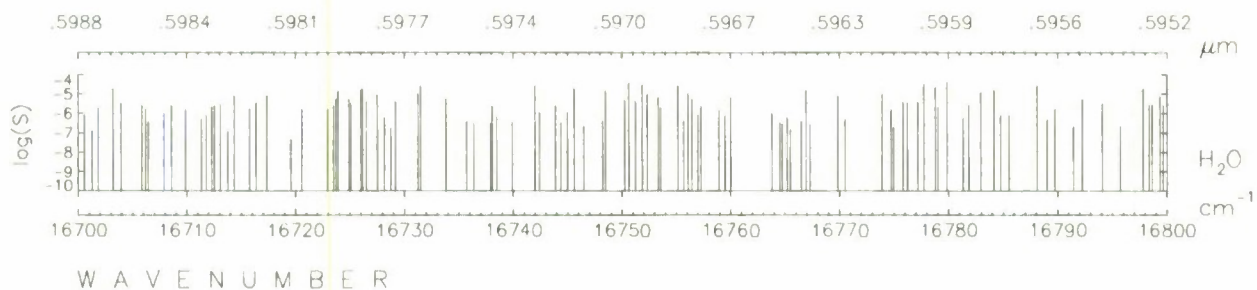


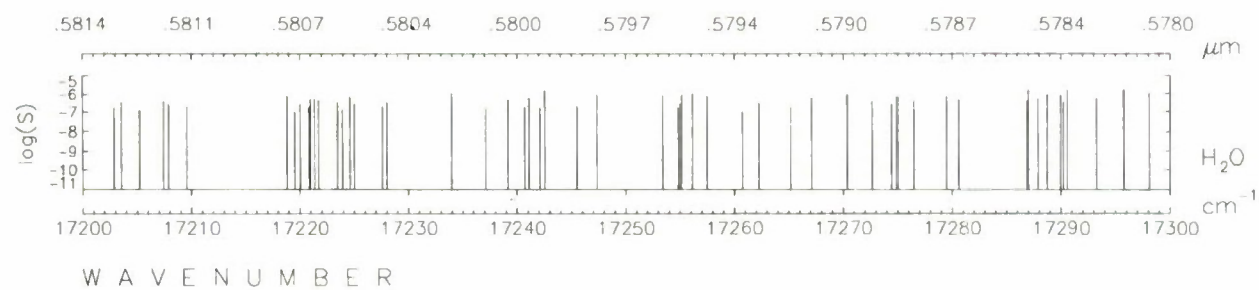
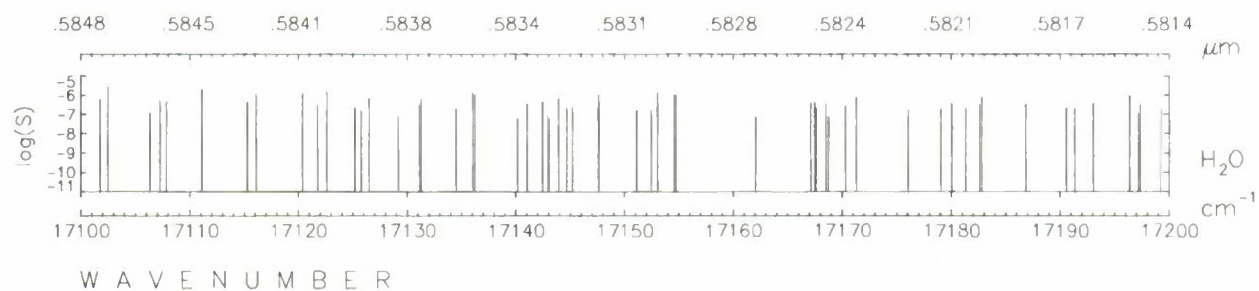
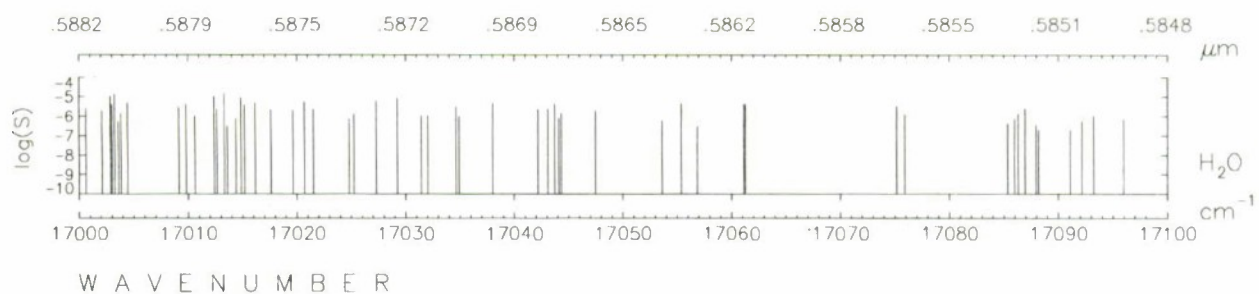


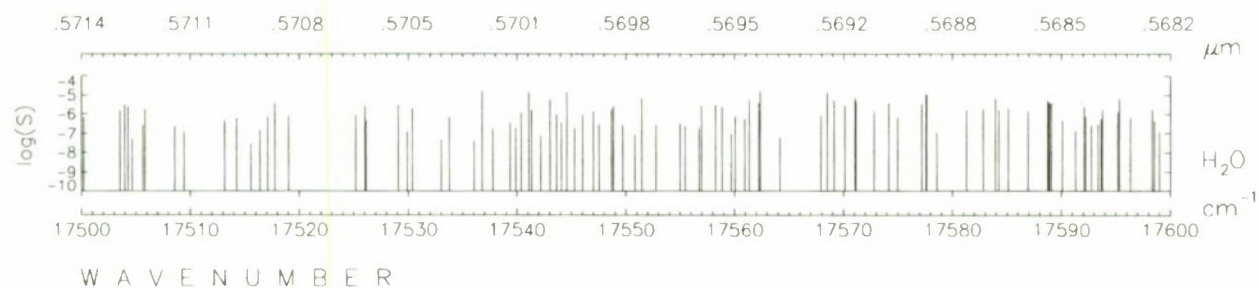
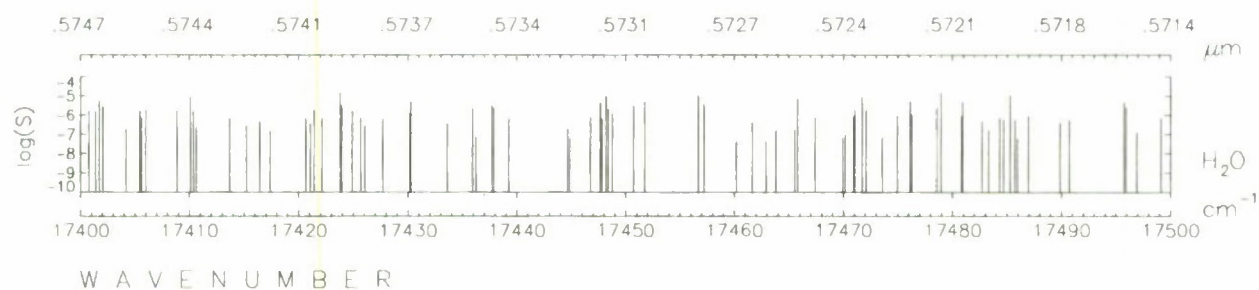
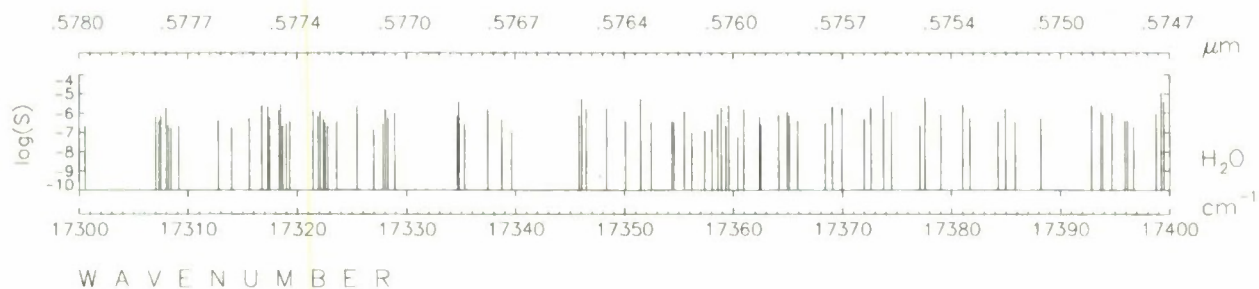


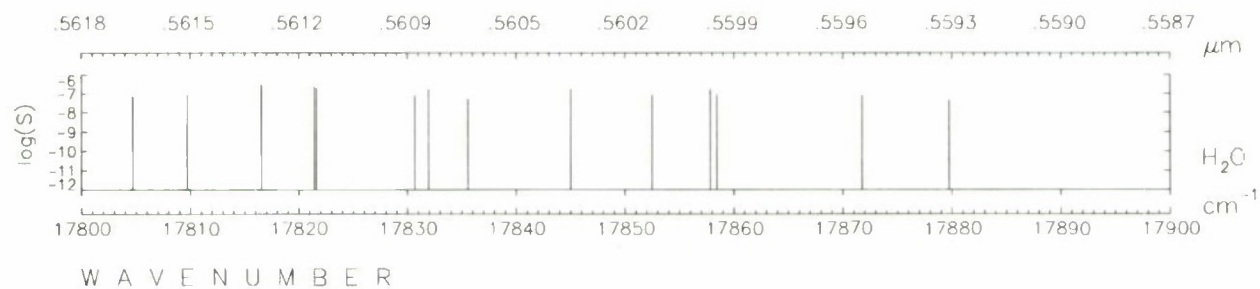
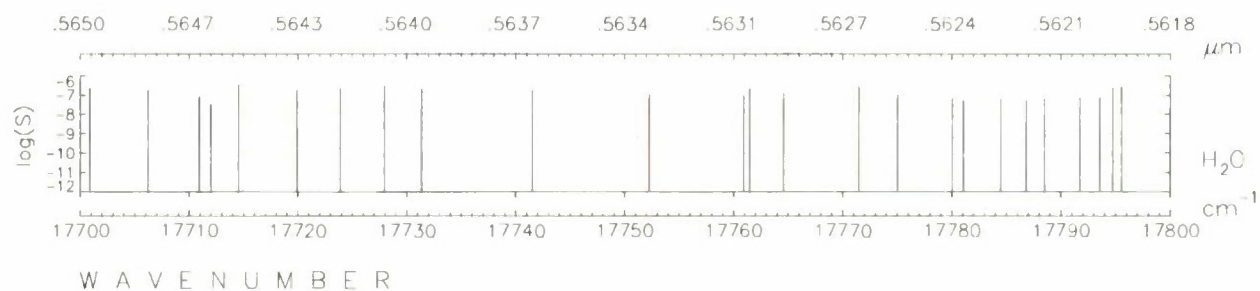
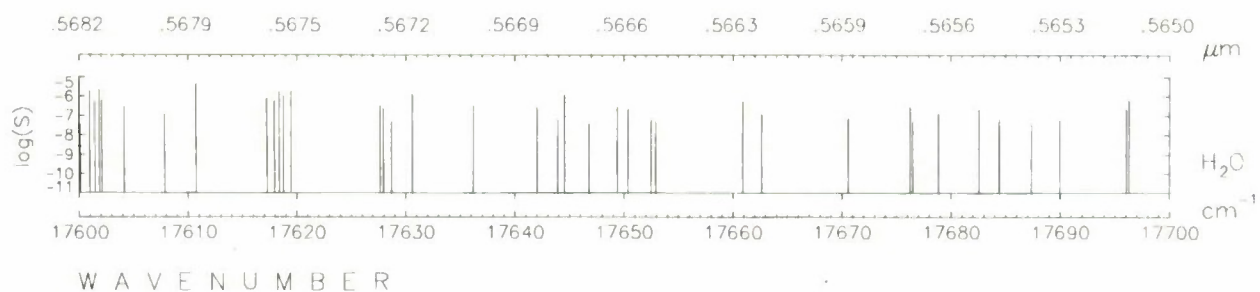












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16. Abstract Plots of logarithm (base 10) of absorption line strength versus wavenumber from 0 to 17 900 cm ⁻¹ are shown for the 28 atmospheric gases (H ₂ O, CO ₂ , O ₃ , N ₂ O, CO, CH ₄ , O ₂ , NO, SO ₂ , NO ₂ , NH ₃ , HNO ₃ , OH, HF, HCl, HBr, HI, ClO, OCS, H ₂ CO, HOCl, N ₂ , HCN, CH ₃ Cl, H ₂ O ₂ , C ₂ H ₂ , C ₂ H ₆ , PH ₃), which appear in the 1986 Air Force Geophysics Laboratory high-resolution transmission molecular absorption data base (HITRAN) compilation, and for O(³ P), 18-O isotopic ozone, and HO ₂ from the 1984 JPL compilation in the 0- to 200-cm ⁻¹ region, and infrared solar CO lines at 4500 K. Also shown are plots of logarithm (base 10) of approximate infrared absorption cross sections of 11 heavy molecules versus wavenumber. The cross-section data cover 700 to 1800 cm ⁻¹ and are included as a separate data file in the 1986 HITRAN database.					
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